ESTCP

FINAL REPORT

# Vertebrae™ Segmented Horizontal Wells for Monitoring PFAS Mass Discharge

Craig Divine
Jesse Wright
Ankit Gupta
***Arcadis U.S., Inc.***

Kristen Hasbrouck
***Tanaq Environmental***

Beth Parker
Steven Chapman
Jonathan Munn
Carlos Maldaner
***University of Guelph***

Lance Robinson
Eric Arenberg
***EN Rx, Inc.***

**April 2025**

**ESTCP Project ER20-5026**

**DISTRIBUTION STATEMENT A**
This document has been cleared for public release.

This report was prepared under contract to the Department of Defense Environmental Security Technology Certification Program (ESTCP). The publication of this report does not indicate endorsement by the Department of Defense, nor should the contents be construed as reflecting the official policy or position of the Department of Defense. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the Department of Defense.

# REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

| 1. REPORT DATE *(DD-MM-YYYY)* | 2. REPORT TYPE | 3. DATES COVERED *(From - To)* |
|---|---|---|
| 23-04-2025 | Final Report | 29-7-2020 to 23-04-2025 |

Final Report - Vertebrae™ Segmented Horizontal Wells for Monitoring PFAS Mass Discharge

5a. CONTRACT NUMBER
20-C-0029

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Craig Divine, Jesse Wright, (Arcadis U.S., Inc.), Kristen Hasbrouck (Tanaq Environmental), Beth Parker, Steven Chapman, Jonathan Munn (University of Guelph), and Lance Robinson (EN Rx, Inc.)

5d. PROJECT NUMBER
ER20-5026

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Arcadis 320 Commerce, Suite 200 Irvine, CA 92602

8. PERFORMING ORGANIZATION REPORT
ER20-5026

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Office of the Deputy Assistant Secretary of
Defense (Energy Resilience & Optimization)
3500 Defense Pentagon, RM 5C646 Washington,
DC 20301-350

10. SPONSOR/ MONITOR'S ACRONYM(S)
ESTCP

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
ER20-5026

12. DISTRIBUTION / AVAILABILITY STATEMENT
DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Contaminant mass flux/discharge can vary through time due to seasonal flow system dynamics, water supply well operations, and remediation activities. Therefore, technologies that provide repeatable, high-resolution mass flux/discharge datasets that can target the important zones within heterogeneous plumes efficiently are needed to optimize remediation performance and determine when to transition to less aggressive technologies and long-term monitoring. The objective of this project is to demonstrate the Vertebrae™ well system (VWS), a next-generation multiport horizontal well technology, for monitoring changes in per- and polyfluoroalkyl substances (PFAS) contaminant mass flux/discharge in groundwater through time.

15. SUBJECT TERMS
Vertebrae™ well system (VWS), a next-generation multiport horizontal well technology

| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT | 18. NUMBER OF PAGES | 19a. NAME OF RESPONSIBLE PERSON |
|---|---|---|---|---|---|
| a. REPORT UNCLASS | b. ABSTRACT UNCLASS | c. THIS PAGE UNCLASS | UNCLASS | 2655 | Craig Divine |
| | | | | | 19b. TELEPHONE NUMBER *(include area code)* 720-308-5367 |

Standard Form 298
(Rev. 8-98)

# FINAL REPORT
Project: ER20-5026

## TABLE OF CONTENTS

**Page**


ABSTRACT ..... XII
EXECUTIVE SUMMARY ..... ES-1
1.0 INTRODUCTION ..... 1
1.1 BACKGROUND ..... 1
1.2 OBJECTIVE OF THE DEMONSTRATION ..... 2
1.3 REGULATORY DRIVERS ..... 3
2.0 TECHNOLOGY ..... 4
2.1 TECHNOLOGY DESCRIPTION ..... 4
2.2 TECHNOLOGY DEVELOPMENT ..... 5
2.3 ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY ..... 6
3.0 PERFORMANCE OBJECTIVES ..... 7
4.0 SITE SELECTION AND DESCRIPTION ..... 10
4.1 SITE LOCATION AND HISTORY ..... 11
4.2 SITE GEOLOGY AND HYDROGEOLOGY ..... 12
4.3 PREVIOUS PER- AND POLYFLUOROALKYL SUBSTANCES CHARACTERIZATION ..... 14
4.3.1 2017 to 2018 Site Investigations ..... 14
4.3.2 Environmental Security Technology Certification Program 2019 Mobile Lab Demonstration and Mass Flux Assessment ..... 14
5.0 TEST DESIGN ..... 20
5.1 CONCEPTUAL EXPERIMENTAL DESIGN ..... 20
5.2 PRE-DESIGN DATA COLLECTION ..... 20
5.2.1 Additional Hydraulic Profile Tool Borings and Vertical Aquifer Profile Sampling ..... 22
5.2.2 Golden Spike Boring ..... 24
5.2.3 Vertical Stand-Alone Integrated Fiber Optic and Heating Cables ..... 27
5.2.4 High-Resolution Multilevel System ..... 29
5.2.5 Conventional Monitoring Wells ..... 30
5.2.6 Pre-Design Investigation-Derived Waste Management ..... 31
5.3 TREATABILITY OR LABORATORY STUDY RESULTS ..... 31
5.4 DESIGN AND LAYOUT OF TECHNOLOGY COMPONENTS ..... 32
5.4.1 VWS Design Components ..... 32
5.4.2 Bore Path Design ..... 37
5.4.3 Drilling and Reaming Operations ..... 38

# TABLE OF CONTENTS (Continued)

**Page**


5.4.4 VWS Installations ..... 39
5.4.5 Well Development ..... 40
5.4.6 Grouting Operations ..... 42
5.4.7 Wellhead Completions ..... 42
5.4.8 Solid and Liquid Waste Management ..... 43
5.5 FIELD TESTING ..... 44
5.6 MONITORING METHODS AND RESULTS ..... 48
5.6.1 VWS Sampling ..... 49
5.6.2 VWS Hydraulic and Tracer Testing ..... 50
5.6.3 Active Fiber Optic Distributed Temperature Sensing Testing ..... 50
5.6.4 Multilevel System Sampling ..... 64
5.6.5 Monitoring Well Sampling ..... 64
5.6.6 Monitoring Well Hydraulic and Tracer Testing ..... 64
5.6.7 Water Level Measurements ..... 65
5.6.8 Purge Water Waste Management ..... 65
6.0 DATA ANALYSIS AND FLUX METHODS ..... 66
6.1 CONTAMINANT MASS FLUX/DISCHARGE ..... 66
6.2 TEMPORAL VARIABILITY ..... 68
6.3 UNCERTAINTY AND BIAS ..... 69
7.0 PERFORMANCE ASSESSMENT ..... 71
7.1 QUANTITATIVE PERFORMANCE OBJECTIVE 1: ACCURATE AND RELIABLE PLACEMENT OF SCREENS IN SUBSURFACE ..... 71
7.1.1 Data Collected ..... 71
7.1.2 Data Interpretation ..... 72
7.2 QUANTITATIVE PERFORMANCE OBJECTIVE 2: VALIDATE METHODS FOR GROUNDWATER FLUX MEASUREMENT WITH VWSS ..... 74
7.2.1 Data Collected ..... 75
7.2.2 Data Interpretation ..... 75
7.3 QUANTITATIVE PERFORMANCE OBJECTIVE 3: ASSESS COMPARABILITY OF SAMPLES COLLECTED FROM VWS SCREENS TO GRAB SAMPLES AND CONVENTIONAL MONITORING WELLS ..... 77
7.3.1 Data Collected ..... 78
7.3.2 Data Interpretation ..... 78
7.4 QUANTITATIVE PERFORMANCE OBJECTIVE 4: DEMONSTRATE METHOD TO IDENTIFY APPROPRIATE MASS FLUX ZONES TO TARGET VWS SCREEN PLACEMENT ..... 80
7.4.1 Data Collected ..... 80
7.4.2 Data Interpretation ..... 80

# TABLE OF CONTENTS (Continued)


**Page**

7.5 QUANTITATIVE PERFORMANCE OBJECTIVE 5: VALIDATE VWS APPLICATION FOR QUANTIFYING MASS FLUX/DISCHARGE ALONG TRANSECTS ..... 81
7.5.1 Data Collected ..... 82
7.5.2 Data Interpretation ..... 82
7.6 QUANTITATIVE PERFORMANCE OBJECTIVE 6: VERIFY MATERIAL COMPATIBILITY WITH PER- AND POLYFLUOROALKYL SUBSTANCES ..... 84
7.6.1 Data Collected ..... 84
7.6.2 Data Interpretation ..... 85
7.7 QUALITATIVE PERFORMANCE OBJECTIVE 1: VWS CAN ASSESS CONTAMINANTS AND CONDITIONS ALONG THE FLOW PATH IN A LONGSECT CONFIGURATION ..... 86
7.7.1 Data Collected ..... 86
7.7.2 Data Interpretation ..... 86
7.8 QUALITATIVE PERFORMANCE OBJECTIVE 2: DEMONSTRATE INTEGRITY OF GROUT SEALS TO ISOLATE INDIVIDUAL SCREEN SEGMENTS ..... 89
7.8.1 Data Collected ..... 89
7.8.2 Data Interpretation ..... 89
7.9 QUALITATIVE PERFORMANCE OBJECTIVE 3: IDENTIFY CHALLENGES AND LIMITATIONS OF VWSS ..... 90
7.9.1 Data Collected ..... 90
7.9.2 Data Interpretation ..... 90
7.10 QUALITATIVE PERFORMANCE OBJECTIVE 4: ASSESS ROBUSTNESS OF THE TECHNOLOGY ..... 91
7.10.1 Data Collected ..... 91
7.10.2 Data Interpretation ..... 92
8.0 COST ASSESSMENT ..... 93
8.1 COST MODEL ..... 93
8.2 COST DRIVERS ..... 95
8.3 COST ANALYSIS ..... 96
9.0 IMPLEMENTATION CONSIDERATIONS ..... 97
10.0 REFERENCES ..... 99
APPENDIX A POINTS OF CONTACT ..... A-1
APPENDIX B HYDRAULIC PROFILING TOOL FINAL DATA REPORT ..... B-1
APPENDIX C LABORATORY ANALYTICAL REPORTS ..... C-1
APPENDIX D HYDRAULIC TESTING ANALYSIS MEMORANDUM – SLUG TESTING ..... D-1
APPENDIX E SOIL BORING LOGS/WELL CONSTRUCTION DIAGRAMS ..... E-1

# TABLE OF CONTENTS (Continued)

**Page**


APPENDIX F GRAIN SIZE ANALYSES AND HYDRAULIC CONDUCTIVITY ESTIMATES ..... F-1

APPENDIX G VERTEBRAE WELL SYSTEM PFAS MATERIALS TESTING ..... G-1

APPENDIX H VWS AS-BUILT FIGURES ..... H-1

APPENDIX I GROUNDWATER SAMPLING LOGS ..... I-1

APPENDIX J HYDRAULIC GRADIENT ANALYSIS ..... J-1

# LIST OF FIGURES

**Page**


Figure 1. Conceptual Depiction of a VWS Measuring PFAS Mass Flux/Discharge ..... 1
Figure 2. VWS4
Figure 3. Installation of VWS ..... 5
Figure 4. Location of Camp Grayling ..... 11
Figure 5. GAAF ..... 12
Figure 6. Photographs of Drill Core (Collected from 15 to 20 bgs; left) and Excavation Cut (Right) at the GAAF ..... 13
Figure 7. GAAF Groundwater Elevation Contour Map ..... 13
Figure 8. HPT Boring and VAP Locations at GAAF Completed as Part of ESTCP Project ER19-5203 ..... 16
Figure 9. Previous Estimated Hydraulic Conductivity Values and Estimated PFOS Mass Flux at Three Transects at GAAF ..... 18
Figure 10. Previous Estimated Hydraulic Conductivity Values and Estimated PFOS Mass Flux Transect 1 at GAAF ..... 18
Figure 11. Locations of the Vertebrae™ Wells and Additional Site Characterization Efforts ..... 21
Figure 12. Photos Taken During Golden Spike Coring Episode ..... 25
Figure 13. Core Photos of Seven Runs (5-foot intervals) from 5 to 40 feet bgs with Recovery Percentages ..... 26
Figure 14. Plots Showing Discrete Samples Selected for Analysis ..... 26
Figure 15. Schematic of A-DTS ..... 27
Figure 16. Direct-Push Installation of Vertical Fiber Optic Cables for A-DTS Testing. ..... 29
Figure 17. Construction and Installation of Seven-Channel CMT Multilevel System ..... 30
Figure 18. Shallow Transect VWS Cross-Section Diagram ..... 34
Figure 19. Fiber Optic Cable Installations ..... 35
Figure 20. Field Photos of Horizontal Fiber Optic Cable Installations for A-DTS Testing ..... 36
Figure 21. Bore Path Design Diagram ..... 38
Figure 22. Photographs of Well Development and Grouting ..... 42
Figure 23. Well Completion and Waste Storage ..... 43
Figure 24. Model Output and Least Squares Fit to Estimate Groundwater Flux from the A-DTS Apparent Thermal Conductivity Data ..... 55
Figure 25. A-DTS Result Montage for the Stand-Alone Horizontal Fiber Optic Cable ..... 56
Figure 26. A-DTS Result Montage for the Horizontal Fiber Optic Cable Integrated into the Shallow VWS ..... 57
Figure 27. GAFF Site Map Showing the Location of the Four Vertical A-DTS Locations (DTS-1, DTS-2, DTS-3, and DTS-4) ..... 60
Figure 28. A-DTS Result Montage for the Vertical Fiber Optic Cable Installations ..... 61
Figure 29. DTS Temperature Data from the Fiber Optic Cable Installed with the VWS for the Shallow Transect Location ..... 63
Figure 30. VWS Data Plots ..... 70
Figure 31. Directional Drilling Navigation ..... 72
Figure 32. Comparison of Planned VWS Screen Depths ..... 74

# LIST OF FIGURES

**Page**


Figure 33. Average Screen Segment Flows (left) for HPT, SWTT, and A-DTS, and Total Transact Calculated Flow for Each Performance Monitoring Event (PM1, PM2, etc.) for All Methods (right). ..... 76
Figure 34. Estimated K at the GAAF vs. Measurement Depth Comparing Multiple Methods ..... 77
Figure 35. RSD of all Groundwater Samples from the 20- to 30-foot Depth Interval ..... 79
Figure 36. Comparison of the Average (solid circles) and Range (horizontal bars) of Samples Collected from the VWS to the Closest VAP or Vertical Monitoring Well (x symbols). ..... 79
Figure 37. 3-D Model Showing Design of the VWSs Based on Available Data. Hydraulic conductivity values are ft/day and PFOS concentrations values are ng/L. ..... 80
Figure 38. Relationship between the Amount of Available Data used and Calculated PFOS Mass Discharge ..... 81
Figure 39. Example EVS Calculated PFAS Mass Flux Distribution for Performance Monitoring Event #2 ..... 82
Figure 40. Comparison of PFOS Mass Discharge Estimates for Each Performance Monitoring Event to the Average of All Methods for Each performance Monitoring Event. ..... 84
Figure 41. Average Longsect VWS (circles) and Conventional Monitoring Well (x's) PFOS (purple) and PFOA (green) Concentrations ..... 87
Figure 42. Relative Concentrations of Primary PFAS Species Along the Inferred Flow Path Distance ..... 88
Figure 43. Distribution of Target PFAS Precursors (6:2-FTS, 8:2-FTS, PFOSA, and 3:3-FTCA) Along the Inferred Flow Path Distance ..... 88

# LIST OF TABLES

**Page**


Table 1. Performance Objectives ..... 7
Table 2. Site Selection Screening Criteria ..... 10
Table 3. Summary of Previously Estimated PFOS and PFOA Mass Discharge Estimates ..... 19
Table 4. Summary of Pre-Design Scope of Work ..... 22
Table 5. PFAS Groundwater Analytical Results – VAP Sampling ..... 24
Table 6. PFAS Soil Analytical Results – DoD ELAP ..... 26
Table 7. PFAS Soil Analytical Results – Top Assay ..... 26
Table 8. PFAS Laboratory Testing of VWS Well Materials ..... 32
Table 9. Overall VWS Design Summary ..... 33
Table 10. Individual VWS Summary ..... 33
Table 11. Completed Project Schedule ..... 47
Table 12. Total Number and Types of Samples Collected ..... 48
Table 13. PFAS Groundwater Analytical Results – Monitoring Wells, MLS, and VWSs ..... 49
Table 14. PFAS Top Assay Groundwater Analytical Results – MLS and VWS ..... 49
Table 15. Physical and Thermal Parameters Used in the Numerical Model ..... 51
Table 16. Model Parameters ..... 51
Table 17. Effective Thermal Conductivity Values from Laboratory Measurements on Samples from Borehole SB02 ..... 52
Table 18. Effective Thermal Conductivity Values from Laboratory Measurements on Samples from Borehole SB03 ..... 52
Table 19. Effective Thermal Conductivity Values from Laboratory Measurements on Samples from Borehole SB04 ..... 54
Table 20. Standalone Cable A-DTS Groundwater Flux Values Averaged Across the VWS Screen Intervals for the Eight Snapshots. ..... 58
Table 21. VWS Fiber Optic Cable A-DTS Groundwater Flux Values Averaged Across the VWS Well Screen Intervals for the Eight Snapshots. ..... 58
Table 22. Groundwater Flux Percent Difference Between Stand-Alone Fiber Optic Cable and Fiber Optic Cable Installed with VWS. ..... 58
Table 23. Seal Position and Length Based on Temperature Response Measured with DTS ..... 64
Table 24. Comparison of Planned and Actual VWS Locations ..... 74
Table 25. Comparison of PFOS Mass Discharge (mg/day) for All Performance Monitoring Events. ..... 83
Table 26. Summary of Detections Material Compatibility Testing ..... 85
Table 27. Cost Model for Three VWSs ..... 94

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| 3-D | three-dimensional |
| 6:2-FTS | 6:2-fluorotelomersulfonic acid |
| 8:2-FTS | 8:2-fluorotelomersulfonic acid |
| °C | degree Celsius |
| % | percent |
| q | groundwater flux |
| β | fitting parameter determined using least squares |
| λa | A-DTS derived apparent thermal conductivity |
| λ0 | apparent thermal conductivity |
| µg/kg | microgram per kilogram |
| | |
| A-DTS | active fiber optic distributed temperature sensing |
| AFFF | aqueous film-forming foam |
| *Ai* | element area |
| AOI | area of interest |
| Arcadis | Arcadis U.S., Inc. |
| ASTM | ASTM International |
| | |
| bgs | below ground surface |
| | |
| CFM | cubic foot per minute |
| *Ci* | contaminant groundwater concentration |
| cm | centimeter |
| CMT | continuous multichannel tubing |
| CSM | conceptual site model |
| | |
| DoD | U.S. Department of Defense |
| DP | Demonstration Plan |
| DTS | distributed temperature sensing |
| | |
| EN Rx | EN Rx, Inc. |
| ESTCP | Environmental Security Technology Certification Program |
| EVS | Earth Volumetric Studio |
| | |
| FTCA | fluorotelomer carboxylic acid |
| FR | Final Report |
| FRA | Final Report Addendum |
| ft/day | foot per day |
| | |
| GAAF | Grayling Army Airfield |
| GAC | granular activated carbon |
| G/NG | Go/No Go Recommendation Memo |
| GW | groundwater |

| | |
|---|---|
| HAL | Health Advisory Limit |
| HDD | horizontal directional drilling |
| HDPE | high-density polyethylene |
| HPT | hydraulic profile tool |
| | |
| *i* | hydraulic gradient |
| IDW | investigation-derived waste |
| ITRC | Interstate Technology & Regulatory Council |
| | |
| J/kgK | joule per kilogram kelvin |
| K | hydraulic conductivity |
| $kg/m^3$ | kilogram per cubic meter |
| | |
| LC-QTOF | liquid chromatography quadrupole time of flight mass spectrometry |
| | |
| MATES | Camp Grayling Maneuver Area Training Equipment Site |
| MCL | Maximum Contaminant Levels (MCL) |
| MDEQ | Michigan Department of Environmental Quality |
| MLS | multilevel system |
| MNA | monitored natural attenuation |
| m/s | meter per second |
| | |
| N/A | not analyzed |
| NA | not applicable |
| ND | nondetect |
| ng/g | nanogram per gram |
| ng/kg | nanogram per kilogram |
| ng/L | nanogram per liter |
| | |
| OD | outer diameter |
| | |
| PA | preliminary assessment |
| PFAS | per- and polyfluoroalkyl substances |
| PFOA | perfluorooctanoic acid |
| PFOS | perfluorooctane sulfonate |
| PFOSA | perflourooctanesulfonamide |
| PFTeDA | perfluorotetradecanoic acid |
| PFTrDA | perfluorotridecanoic acid |
| PST | pneumatic slug test |
| PVC | polyvinyl chloride |
| | |
| *qi* | groundwater flux |
| QSM | quality systems manual |
| | |
| RF | radiofrequency |
| RI | remedial investigation |

| | |
|---|---|
| RPD | relative percent difference |
| RSD | relative standard deviation? See Section 7.2 |
| SDR | standard dimensional ratio |
| SERDP | Strategic Environmental Research and Development Program |
| SI | site inspection |
| SSM | Site Selection Memo |
| SWTT | single-well tracer test |
| TGI | Technical Guidance Instruction |
| TOP | total oxidizable precursors |
| TT | technology transfer |
| USEPA | United States Environmental Protection Agency |
| VAP | vertical aquifer profile |
| VWS | Vertebrae™ well system |
| W/m | watt per meter |
| W/mk | watt per meter kelvin |

**ACKNOWLEDGMENTS**

This demonstration project was successfully completed as a direct result of the critical contributions of dozens of individuals and multiple organizations. Specific acknowledgement is extended to:

- Arcadis U.S., Inc.: Hoa Voscott, Austin Westhuis, Trey Fortner
- En Rx, Inc.: Lance I. Robinson, PE, Stephen S. Koenigsberg PhD, Wes Wiley, PG
- Army National Guard: Bonnie Packer, PhD
- Michigan Army National Guard: Jonathan Edgerly
- Michigan Environment, Great Lakes, and Energy: Christiaan Bonn
- University of Guelph: Dr. Carlos Maldaner (support with original project proposal A-DTS scope and budget), Brad Chapman, EIT (grain size analyses, K-estimates); Stephane Lauzon (field A-DTS testing)

Thank you for all your efforts and support!

# ABSTRACT


## INTRODUCTION AND OBJECTIVES

Contaminant mass flux/discharge can vary through time due to seasonal flow system dynamics, water supply well operations, and remediation activities. Therefore, technologies that provide repeatable, high-resolution mass flux/discharge datasets that can target the important zones within heterogeneous plumes efficiently are needed to optimize remediation performance and determine when to transition to less aggressive technologies and long-term monitoring. The objective of this project is to demonstrate the Vertebrae™ well system (VWS), a next-generation multiport horizontal well technology, for monitoring changes in per- and polyfluoroalkyl substances (PFAS) contaminant mass flux/discharge in groundwater through time.

## TECHNOLOGY DESCRIPTION

The VWS is a single, horizontal multiport system, with each port accessed via small-diameter tubes attached to screen segments or ports isolated with bentonite seals. The VWS technology can be applied as a variation of the conventional transect approach. Monitoring points are installed horizontally instead of vertically, with improved coverage along the width of the plume at targeted depths (i.e., horizontal horizons) with highest concentrations or flux, but with generally lower vertical resolution due to practical limits on placing multiple systems at different depths. The approach is advantageous because plumes are often anisotropic along horizontal bedding planes and the placement of multiple, closely spaced measuring points across a transect along a horizontal plane can be easily installed from a single boring, reducing costs. Furthermore, horizontal installations can allow access to zones that may be inaccessible via vertical boreholes.

## PERFORMANCE AND COST ASSESSMENT

Multiple VWSs were installed at the Grayling Army Airfield in Grayling, Michigan. Two VWSs (at different depth intervals) were installed transverse to groundwater flow (i.e., transects) downgradient of a PFAS source area. Following installation, performance monitoring was completed to assess various performance objectives. The demonstration confirmed the integrity of the grout seals separating screen sections, well screens can be placed accurately (+/- 1.5 vertical feet) within the subsurface (in comparable settings), single-well tracer techniques and fiber-optic-based distributed temperature sensing can be used to quantify groundwater flux, and the technology is appropriate for quantifying mass flux/discharge along transects. The main cost drivers of the technology are the number of VWSs and segments, VWS length and depth, and site lithology. As a simple example, two 500-foot-long VWSs (installed in comparable settings), both with up to 10 screens, can generally be installed in less than 1 week and drilling and materials may cost approximately $150,000. Costs for longer wells (800 to 1,200 feet) increase linearly, while the cost per foot increases for shorter wells (less than 300 feet).

## IMPLEMENTATION ISSUES

VWSs are most advantageous for difficult-to-access plumes under buildings, roads, flight lines, and other surface infrastructure, and therefore represent minimal potential to impact facility operations during installation and sampling. VWSs will be utilized primarily to facilitate long-term monitoring as opposed to plume delineation, because detailed lithologic information is not obtained during the directional drilling installation process. For optimal design and to maximize the performance of this technology, concentrations and the lithology of the plume should be well-understood to support VWS design.

## PUBLICATION

Horst, Divine, Quinnan, Lang, Carter, Guillette, Pulikkal. 2022. Where is the PFAS? Innovations in PFAS detection and characterization. *Groundwater Monitoring & Remediation*, 42: 13-23, doi: 10.1111/gwmr.12502.

# EXECUTIVE SUMMARY

## INTRODUCTION

Contaminant mass flux/discharge estimation is challenging because it requires high-resolution measurements of both contaminant concentrations and groundwater flux, which can be highly variable spatially due to orders of magnitude variations in concentration and hydraulic conductivity in short distances. Mass flux can also vary through time due to seasonal flow system dynamics, water supply well operations, and remediation activities. Therefore, technologies that provide repeatable, high-resolution mass flux/discharge datasets that can target the important zones within heterogeneous plumes efficiently are needed to optimize remediation performance and determine when to transition to less aggressive technologies and long-term monitoring.

Of the methods that are available to measure contaminant mass flux/discharge, the transect method is probably the most insightful and commonly used because it couples with characterization (Guilbeault et al. 2005; Einarson et al. 2010; Interstate Technology & Regulatory Council [ITRC] 2010; Einarson 2017). Traditionally, the transect approach involves vertically drilled permanent or temporary (i.e., snapshot) borings, well clusters, or multiport systems oriented perpendicular to groundwater flow across a groundwater plume. However, this approach can be costly because it requires many individual vertical boring locations (which requires surface access) given typical high spatial variability in plumes, and many hundreds of feet of drilling with uncertainty in the horizontal direction between vertical locations. This is especially important if the target interval is relatively deep or requires high vertical resolution monitoring or sampling at each location along the transect. Direct contaminant flux approaches such as passive flux meters (Annable et al. 2005; Klammler et al. 2007) are also generally applied at high spatial resolution along monitoring transects, typically using vertical deployments and conventional wells rather than multiport systems.

The conventional transect method for characterizing contaminant mass flux relies on a series of temporary or permanent vertical monitoring points providing data in vertical profiles along a transect across the entire plume, perpendicular to groundwater flow (ITRC 2010). The monitoring points are sampled to provide concentration data across the control plane at appropriate lateral and vertical spacing to capture the plume concentration distribution (boundaries and internal variability). An appropriate method for measuring groundwater flux at similar high resolution is also required and the combined groundwater concentration and flux data are used to assess contaminant mass flux/discharge across the transect (note: this is focused on the mobile groundwater phase and water phase, and does not capture mass stored as sorbed phase within the plume, which can be significant in many lithologies and relevant to site management decisions). The purpose and scope of this project is to demonstrate the Vertebrae™ well system (VWS), a next-generation segmented, nested horizontal well technology (Koenigsberg et al. 2018), for monitoring changes in contaminant mass flux/discharge emanating from source zones and high-concentration areas through time (Figure ES-1, below). During the past decade, more than 200 VWSs have been installed in the field for general plume monitoring, remediation fluid injections, air sparging, and soil vapor extraction; however, they have not been specifically designed to monitor mass flux/discharge and have not previously been used for per- and polyfluoroalkyl substances (PFAS) contaminants.

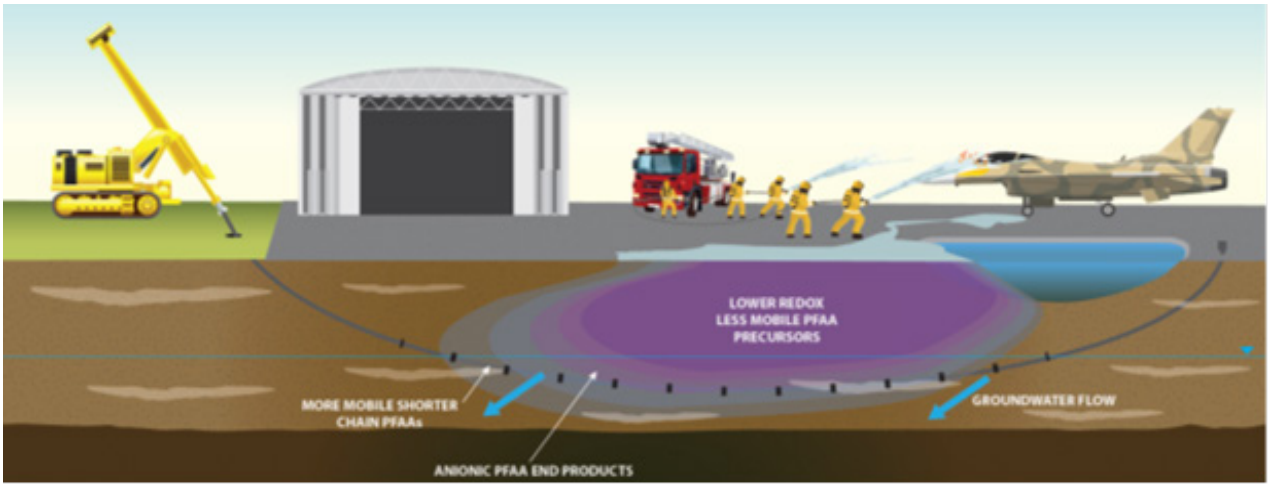



**Figure ES-1. Conceptual Depiction of a Vertebrae™ Well System Measuring PFAS Mass Flux/Discharge**

Further development of the application of the VWS technology will benefit the U.S. Department of Defense (DoD) and the environmental community at large because it will contribute to advancement with both cost and effectiveness in understanding contaminant mass flux/discharge in site assessment, remediation, and monitoring. In particular, the VWS will enable precise and repeatable monitoring of mass concentrations and discharge with intervals oriented to intersect zones with high concentrations/ flux emanating from complex source zones through time, supporting more reliable risk assessment, remedy performance assessment and optimization, and transition from active to passive remedies. The technology is applicable to many types of groundwater contamination; however, it offers particular potential for monitoring mass discharge changes through time from PFAS sources. Scaled up across the portfolio of DoD sites, this could result in significant total savings for remedy implementation through more reliable characterization, risk assessment, flux-based decision making, and better remedy design and operation with improved performance monitoring.

## OBJECTIVES

The overall goal of this project is to demonstrate and validate the Vertebrae™ horizontal multiport well system as a technology for reliable long-term monitoring of contaminant mass flux/discharge from PFAS source zones. Specific performance objectives are presented in Table ES-1, below.

**Table ES-1. Performance Objectives**

| Performance Objective | Data Requirements | Success Criteria | Success Criteria Achieved? |
|---|---|---|---|
| **Quantitative Objectives** | | | |
| 1. Accurate and reliable placement of screens in subsurface. | Bore-path drilling navigation data, and post-installation geophysical survey data. | Eighty percent (%) of all drilling navigation data agree within 1.5 foot (elevation) of the bore path elevation and 80% of the as-built data agree within 1.5 foot of the planned target depth elevations. | **Yes**<br>Six of six screens along horizontal section were within 1.5 vertical feet of the target elevations and positions. |

**Table ES-1. Performance Objectives (Continued)**

| Performance Objective | Data Requirements | Success Criteria | Success Criteria Achieved? |
|---|---|---|---|
| 2. Validate methods for groundwater flux measurement with VWSs. | Hydraulic conductivity, hydraulic gradient, tracer test data, active fiber optic distributed temperature sensing (A-DTS) data. | Complete successful field testing of methods. For each method estimates that are repeatable (±25%) and agree with the averages from all the methods within 25% according to an analysis of variance statistical test (within 25% at an 80% confidence). | **Yes** Both the A-DTS and single-well tracer test methods are considered to have achieved success for this performance objective, based on modified criteria. |
| 3. Assess comparability of samples collected from VWS screens to grab samples. | Concentration data from Vertebrae™ screens and co-located vertical cores/wells or groundwater grab samples. | Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) concentrations measured from the Vertebrae™ screens agree within 1 order of magnitude for at least 75% of co-located grab samples. | **Yes** Sample results from the VWS are consistent with conventional sampling methods. |
| 4. Demonstrate method to identify appropriate mass flux zones to target Vertebrae™ placement. | All currently existing hydraulic, hydraulic profile tool, and groundwater grab sample concentration data as well as additional high-resolution data developed during the pre-design investigation. | Achieved if a relationship between pre-design data availability and the predicted mass discharge measured from the resulting VWS designs can be developed, and if this relationship indicates the VWS design will yield a mass discharge estimate within ±25% of the estimated derived from other data. | **Partially** A clear relationship between data used and the calculated mass discharge was developed via a practical method. However, the analysis did not yield results that agreed within ±25% |
| 5. Validate VWS application for quantifying mass flux/discharge along transects. | Mass flux/discharge estimates normal to groundwater flow for VWSs and conventional vertical borings/ wells installed along a nearby transect. These estimates will be derived from PFAS concentration data and darcy flux values determined from hydraulic testing, tracer testing, the A-DTS. | Mass flux/discharge estimates with VWSs agree with conventional approaches within 25% with equal or lower uncertainty estimated through propagation of uncertainty statistical techniques. | **Yes** None of the methods meet this statistical level, however, this may have been an unrealistic success criterion. The average results for both the HPT and DTS agree with the EVS result within an order of magnitude and event-to-event variability is similar for all of the methods. This implies that the differences in methods are related more toward a systemic consistent bias rather than precision and repeatability. Consequently, the results support the use of VWS for PFAS mass discharge estimation. |

**Table ES-1. Performance Objectives (Continued)**

| Performance Objective | Data Requirements | Success Criteria | Success Criteria Achieved? |
|---|---|---|---|
| 6. Verify materials' compatibility with PFAS. | Rinsate blank and PFAS stock solution samples after contact with VWS components. | PFOS and PFOA are less than the United States Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs) of 4.0 nanograms per liter in rinsate blank samples and PFAS loss from the sample due to sorption to well materials is less than 10% or the analytical precision (whichever is greater) for each tested compound. | **Yes** The VWSs can be tested prior to production for certification to be free of primary PFAS analytes. |
| **Qualitative Objectives** | | | |
| 1. VWS can assess contaminants and conditions along the flow path in a longsect configuration. | Contaminant concentrations data from longsect VWS, monitoring wells, and vertical aquifer profile samples. | PFAS concentration data collected from different screen intervals located progressively downgradient follow discernable and consistent trends, indicating the samples represent locations along a constant flow path. | **Yes** Samples from the VWS were generally consistent with other sample types and exhibited high spatial correlation. |
| 2. Demonstrate integrity of grout seals to isolate individual screen segments. | Pressure data from injection tests and A-DTS temperature data measured under passive and active (heated) conditions. | Pressure data do not show clear evidence of seal failure and A-DTS data delineate continuous seals that are at least 5 feet long between each well screen. | **Yes** Grout seals in the horizontal section are placed where intended and are largely functioning as intended (hydraulic separation). |
| 3. Identify challenges and limitations of VWSs. | Feedback from drillers, installation, and monitoring personnel and project technical staff. | Challenges and limitations are understood and can be readily mitigated. | **Yes** No implementation or operational challenges were identified that would limit widespread application. |
| 4. Assess robustness of the technology. | Feedback from geologists and field staff regarding observed ruggedness and performance of screens, sampling ports, connections, and other well components. | No fundamental design flaws/limitations identified, and no systemic problems experienced during installation and sampling. | **Yes.** |

## TECHNOLOGY DESCRIPTION

The VWS is a single, small-diameter horizontal well that contains multiple isolated screen segments as individual ports each with a small-diameter tube connected to ground surface. Essentially it is an engineered multiport well that is installed horizontally instead of vertically (Figure ES-2, below). The VWS can provide another transect method option as a complement or alternative to the conventional vertical installation transect option. The VWS is unique, with many discrete screen zones running horizontally along its length and separate, small-diameter tubing

plumbed from each screen to the surface. Grout, which is tremied in, is used to isolate the individual tailor-designed screen intervals. The VWS technology can be applied as a variation of the conventional transect approach. The difference is the monitoring points are installed horizontally instead of vertically, with improved coverage along the width of the plume at targeted depths with highest concentrations or flux, but with generally lower vertical resolution due to practical limits on placing multiple systems at different depths. The VWS approach is novel and advantageous because multiple closely spaced measuring points across a transect can be easily installed from a single boring (reducing costs) and contaminant zones that may have been previously inaccessible via vertical boreholes can be characterized. Currently, detailed geologic information is not readily available during the drilling process; therefore, an accurate understanding of contaminant distribution within the site hydrostratigraphy from high-resolution characterization using direct-push methods or vertical borings to obtain profiles is required to optimize placement of the horizontal wells and to select target intervals for the monitoring zones.

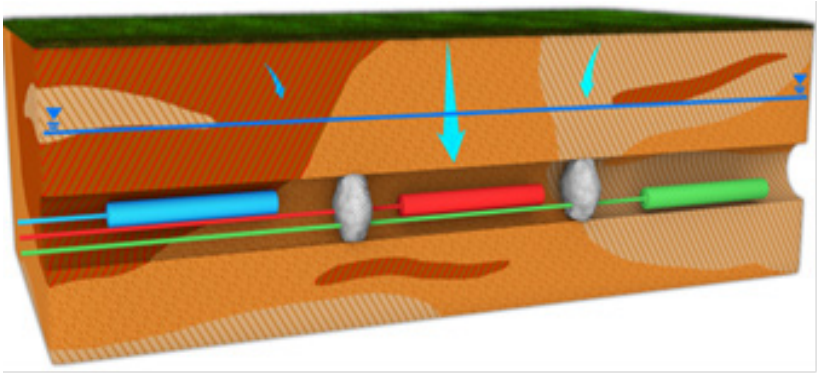


**Figure ES-2. Vertebrae™ Well System (VWS)**

*The VWS contains multiple screen segments separated by grout seals with independent connections to the surface. It can be thought of as a nested well installed horizontally.*

VWSs are installed using horizontal directional drilling (HDD), which is a mud rotary drilling process that uses a specialized rig and asymmetric bit to drill a curved borehole along a predetermined bore path and the prefabricated VWS is pulled into the borehole (Figure ES-3, below). The VWS is a multiport horizontal well that has been installed with as many as 18 discrete screened zones (however, these values are not upper limits; additional screened zones are feasible). To date, VWS wells exceeding 900 feet long and 45 feet deep have been installed, but longer and deeper wells with currently available drilling technology are feasible. The VWS can be thought of as a nested well with small-diameter tubes installed horizontally instead of vertically. Individual screen lengths range from 3 to 30 feet with separate 0.5- to 1.5-inch-diameter tubing plumbed from each screen to the surface. Multiposition monitoring along horizontal paths can be more efficient because it is aligned with hydrologically significant zones within and at the boundaries of aquifers parallel to layering typical of sedimentary facies. Grout is used to isolate the individual screen intervals within the horizontal well (shown on Figure ES-2, above) and reliable placement is key to effective installations tested herein. EN Rx, Inc. has developed a proprietary grout seal mixture to increase elasticity, longevity, and sealing efficiency to isolate the intervals in each horizontal boring. The VWS is compatible with all common contaminant types and has been used at sites with PFAS (this project was the first site where the VWS was deployed for monitoring PFAS), petroleum hydrocarbons, chlorinated solvents, metals, and high salinity.



**Figure ES-3. Photographs of the Installation of the VWS**

*Left: horizontal directional drilling and mud pit. Middle: asymmetric drill bit. Right: Preconstructed VWS immediately prior to pullback into the borehole.*

## PERFORMANCE ASSESSMENT

The data collected as part of this project were evaluated to determine if the success criteria for specific quantitative and qualitative performance objectives presented in Table ES-1, above, were achieved. This section discusses the assessment of each performance objective.

### *Quantitative Performance Objective 1: Accurate and Reliable Placement of Screens in Subsurface*

This performance objective is intended to:

- Assess the reliability of bore-path navigation data for documenting as-built completion.
- Verify that the VWS can be successfully installed at planned target depth intervals.

The following data were collected to evaluate accurate and reliable placement of the VWS screens:

- A walkover locating system was used to track the position of the drill head. The position of the drill head was marked when an additional drill rod was added to the drill string (every 10 feet).
- The locations of the screens at the shallow and deep transects were determined using RF inductive line tracing with a multifrequency transmitter and receiver.

The coordinates were then used to calculate vertical differences for comparison to the success criteria. The goal was to install the VWS within 1 foot of the planned target depth. However, there are inherent limitations in the accuracy of depth measurements collected during and after directional drilling. For these reasons, depth measurements during (drilling navigation data) and after VWS installation (geophysical methods) have an inherent irreducible uncertainty of +/- 0.5 foot. Therefore, the depth accuracy of +/- 0.5 foot was added to the goal of +/- 1 foot, resulting in the overall target tolerance limit of 1.5 feet.

The differences between the measurements were within the tolerance limit of +/- 1.5 feet for all six horizontal screens. When evaluating this performance objective, only the six shallow transect VWS screens along the horizontal section were considered (Figure 32). The two screens on the slopes (one at each end) of the shallow transect were omitted due to decreased accuracy of the walkover locating system when drilling at an angle from horizontal. When drilling at an angle, the three signals (front, back, and center sight) emitted by the sonde travel a longer distance to the receiver at the surface, which decreases the accuracy. A future recommendation (see Section 9) is to avoid placing screens on the sloped portion of the wellbore, due to decreased locating accuracy. In addition, the angled screen orientation increases the potential for grout intrusion into the screen, which is another reason to avoid installing screens at an angle. *Based on the discussion above, the performance objective related to accurate and reliable placement of VWS screens in the subsurface is considered achieved.*

***Quantitative Performance Objective 2: Validate Methods for Groundwater Flux Measurement with VWSs***

This performance objective is intended to assess the reliability and usefulness of several different methods for measuring groundwater flux across a VWS. Groundwater flux across the transect was measured by multiple independent methods. The first method used K estimated from hydraulic tests completed during hydraulic profile tool (HPT) in the VWS well screens and the measured site hydraulic gradient according to Darcy's Law. The second method was based on groundwater flux directly measured from single-well tracer tests (SWTTs). The third method used data from active fiber optic distributed temperature sensing (A-DTS). Because the DTS system was only installed along the shallow transect, the groundwater flux and flow calculations for each method are compared for only the shallow zone.

Figure ES-4 (left), shows the average screen segment flows (average of eight monitoring events) for each of the primary comparison methods (HPT, SWTT, and A-DTS). Figure ES-4 (right) shows total transact calculated flow for each monitoring event. For comparison, this figure also shows average flows calculated using K-estimates based on size analyses from soil core samples ("Grain Size") and geostatistical-based (i.e., kriging) model of K-distribution based on all available K information at the site. The results based HPT data are notably lower than the other two methods for all segments and events. It is likely that for the Grayling Army Airfield (GAAF), this is a biased-low method because the range for most K measurements at the GAAF (Figure 34, 30 to 300 ft/day) is near the approximate upper method limit for HPT testing (approximately 50 to 100 ft/day). Therefore, the HPT method is not considered reliable for the GAAF; however, it may be appropriate for sites with lower hydraulic conductivity.

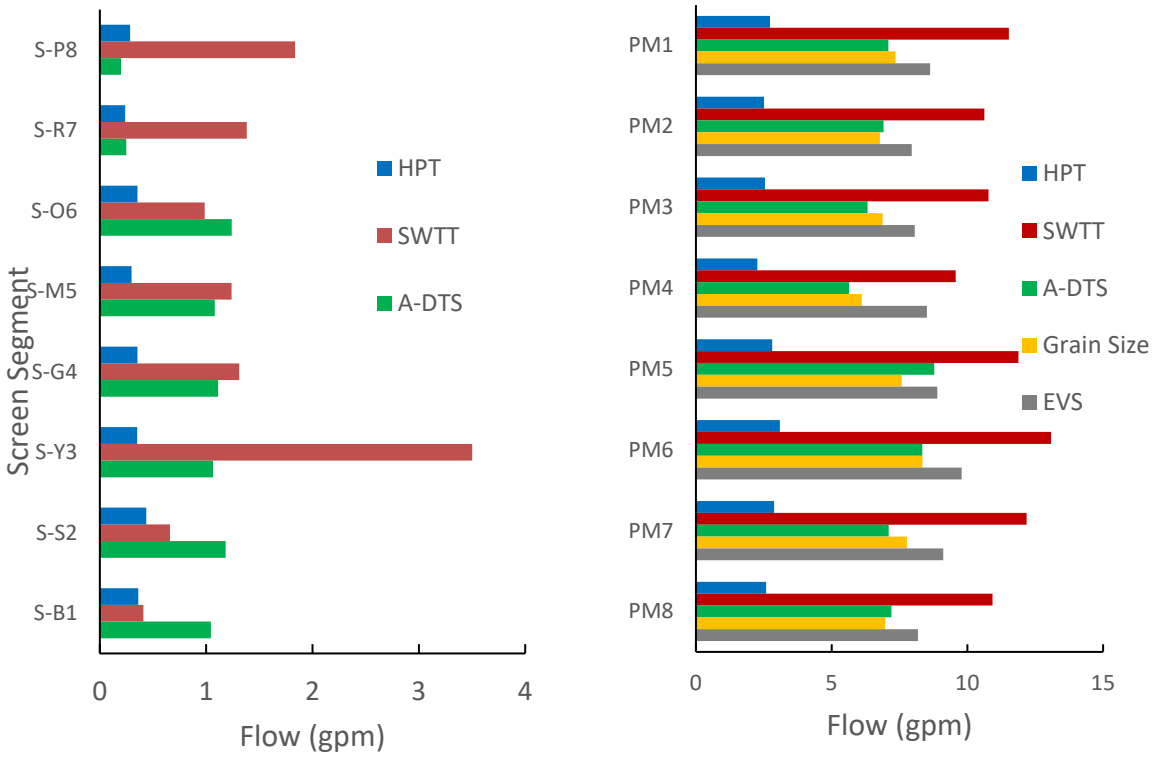



**Figure ES-4. Average Screen Segment Flows (left) for HPT, SWTT, and A-DTS, and Total Transact Calculated Flow for Each Performance Monitoring Event (PM1, PM2, etc.) for All Methods (right).**

The results for the DTS and SWT methods are similar for some screen segments and monitoring events, however, there are some screen segments where the SWTT method is up to twice as high as the DTS method. Based on the highly uniform K distribution at the site (Figure 34), it is unlikely that much higher permeability zones exist at those screens, and rather the SWTT method may be less reliable or biased high at these locations. In the Demonstration Plan (Divine et al. 2021c), it was proposed that success would be evaluated individually for each of the three methods and the performance objective would be considered to be achieved if:

- Repeated flux estimates for a specific method have an average relative percent difference (RPD) of <±25%.
- If through application of statistical analysis of variance, the result for a specific method agrees within 25% at an 80% confidence with the average of all methods.

If one method is determined to have failed, its result will be excluded from the average. For the relative standard deviation (RSD) for total transect flow across all eight monitoring events is similar, 14 and 10% for the DTS and SWTT methods, respectively. Because the HPT data are considered biased low, this second component of the success criteria cannot be evaluated as stated. Generally, it is believed that some SWTT results for individual screens may be biased high because the low geologic heterogeneity would be expected to result in more uniform values across screen sections; however, conclusive data are not available requiring that the SWTT results be considered less reliable than the HPT results. Therefore, both methods are considered reliable and application of an averaging and complimentary approach likely results in the best estimate for the GAAF.

*Based on modified criteria, both the DTS and SWTT methods are considered to have achieved success for this performance objective.*

***Quantitative Performance Objective 3: Assess Comparability of Samples Collected from VWS Screens to Grab Samples and Conventional Monitoring Wells***

This performance objective is intended to demonstrate that the groundwater samples collected from VWS screens are comparable to groundwater samples collected by conventional sampling methods commonly used in site characterization investigations, such as grab (e.g., VAP) samples obtained from direct-push drilling systems and samples from vertical monitoring wells. This performance objective was defined to confirm the overall representativeness of samples collected from the VWS and still accommodate irresolvable variances that may be the result of plume spatial variability caused by small-scale aquifer heterogeneity and flow system, and source variability and inherent differences in sampling methods.

Samples were collected quarterly from each individual screen in each VWS. These results were compared to nearby co-located groundwater samples from vertical borings and multilevel or conventional monitoring wells. These included one-time VAP grab samples collected as part of the prior ESTCP project at the GAAF (ER19-5203) and this ESTCP project. New multilevel and conventional wells installed during this project were also sampled multiple times. Sampling of these wells coincided sampling of the VWSs.

The high-resolution groundwater data generated from the previous ESTCP project at the site (completed in 2019) were evaluated to provide a basis for the success criteria for this performance objective. Numerous borings were installed previously, and VAP groundwater samples were collected from six to eight discrete intervals for each boring, generally between 15 and 50 feet below ground surface. Because the interval between 20 to 30 feet is the most important, the RSD of all samples collected from this interval was calculated for each boring. In general, RSD values range from less than 10% to more than 100% and appear to be independent of concentration magnitude. The average RSDs for PFOA and PFOS are 77 and 73%, respectively. Considering the uncertainty and limitations of the data, the average RPD for these data for the target interval is estimated to be 80%. In general, sample results from the VWS are consistent with conventional sampling methods. The average RSDs for PFOA and PFOS are 59 and 62% (less than the goal of 80%), range from 1 to 182%, and appear to be independent of concentration magnitude. *This comparison confirms the overall representativeness of samples collected from VWSs and the criteria for this performance objective are considered achieved.*

***Quantitative Performance Objective 4: Demonstrate Method to Identify Appropriate Mass Flux Zones to Target VWS Screen Placement***

This performance objective is intended to assess the practical and cost-effective use of prior site information and pre-design vertical characterization data to design a VWS that is optimally placed and will yield reliable contaminant mass flux/discharge information. Data used to support the assessment of this performance objective included all previously existing HPT and VAP groundwater grab sample concentration data as well as additional high-resolution data collected during the pre-design investigation (see Section 5.2). These data were incorporated into the existing 3-D site model (EVS model) used in a complimentary effort to design the placement locations of the VWSs.

The VWSs were designed to yield mass discharge estimates that agree with the results from the EVS model which includes all other available site data. This evaluation is specifically considered in Performance Objective 5.

To understand the amount of pre-design data necessary to support a reliable design, a bootstrapping-type exercise was performed. PFOS mass discharge was calculated using all site data (i.e., 100% of data) and then some data were sequentially removed and PFOS mass discharge was recalculated. The predicted mass discharge values from these alternate designs were calculated and compared. These results are shown in Figure ES-5. The y-axis represents the calculated PFOS mass discharge values for each model normalized to the value from the 100% model. This is a practical approach whereby a relationship between the amount of pre-design data available and the predicted mass discharge measured from the resulting VWS design can be developed. As seen in Figure ES-5, similar PFOS mass discharge values are estimated when 100, 90, 80, and 60% of all available data were used. More significant variation is observed when 40 and 20% of the data are used. This implies that more than enough pre-design data were available to support the VWS design. This performance objective is considered partially achieved because a clear relationship between data used and the calculated mass discharge was developed via a practical method. However, the analysis did not yield results that agreed within ±25% of the mass discharge estimated independently from the other available site data (e.g., on Figure ES-5, below, calculated relative mass discharge values between 0.75 and 1.25). The average results from the HPT, DTS, and SWTT methods yielded results of 1.4, 1.6, and 6 respectively. However, as discussed further in Performance Objective 5, the ±25% target is likely overly and unnecessarily optimistic given the geologic complexities and concentration variability. As such, this performance objective may still be considered achieved.

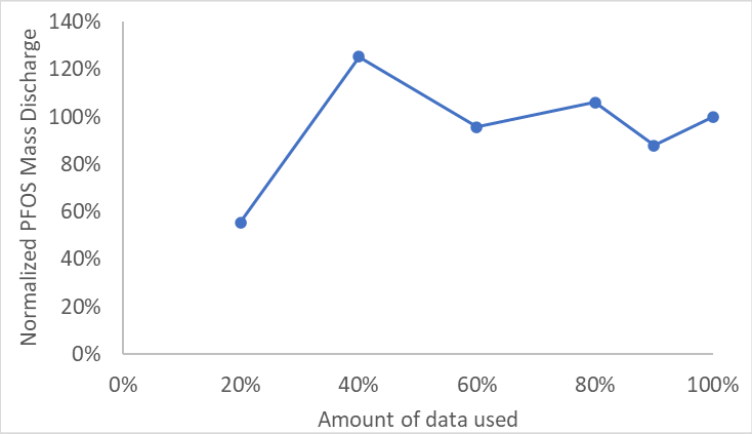



**Figure ES-5. Relationship Between the Amount of Available Data used and Calculated PFOS Mass Discharge**

***Quantitative Performance Objective 5: Validate VWS Application for Quantifying Mass Flux/Discharge Along Transects***

This performance objective is intended to verify the reliability of using VWS transects to measure PFAS mass flux/discharge. Mass flux/discharge normal to groundwater flow were calculated for the transect VWSs using groundwater samples collected from VWS well screens and the different measures of Darcy flux attributed to each of the screen zones (hydraulic testing, point-dilution tracer testing, A-DTS). These estimates were compared to mass discharges estimates developed from

geostatistical modeling of hydraulic conductivity data from conventional vertical borings/wells installed along the same transect (most of these data were developed under prior ESTCP project ER19-5203 and were supplemented with new data collection) and PFAS concentrations measured in VWSs for each performance monitoring event. These analyses were completed in EVS and an example of the calculated PFOS mass flux distribution is shown on Figure ES-6, below (the hydraulic conductivity field is depicted in greyscale and the mass discharge distribution is depicted in color flood with the high values corresponding to warmer colors).

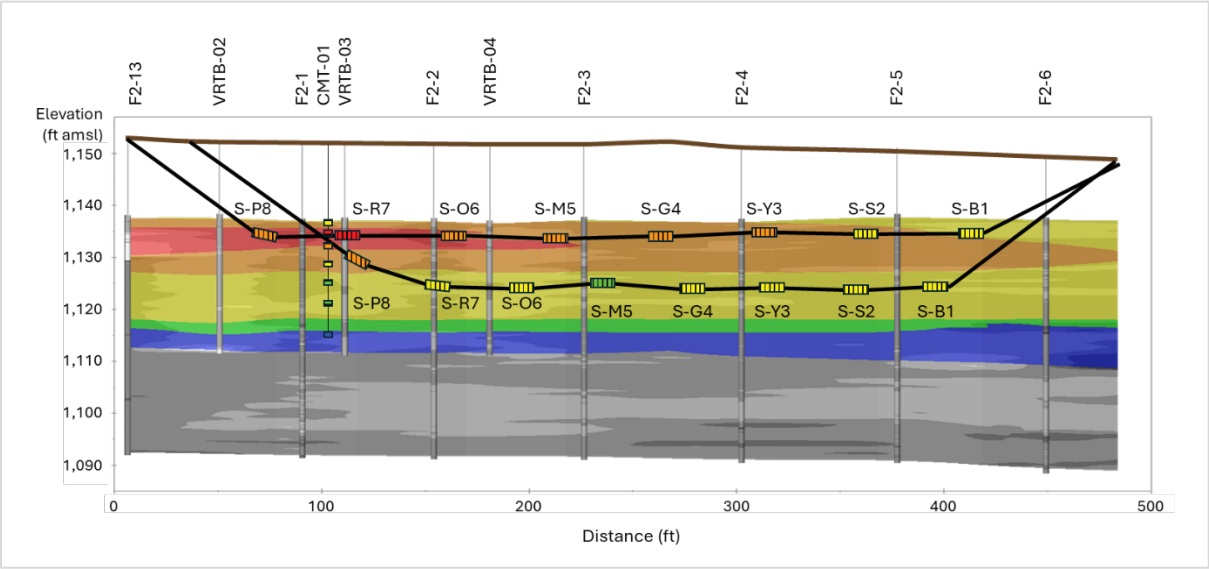



**Figure ES-6. Example EVS Calculated PFAS Mass Flux Distribution for Performance Monitoring Event #2**

The average PFOS mass discharge estimates for each method and for each monitoring event ranged from 58 to 326 mg/day (0.21 to 0.12 kg/year). Although the EVS-based method utilizes the most site geological data it should not necessarily be considered the "gold standard" since its results are highly dependent on geostatistical parameter values and associated data interpolation. This method consistently yielded some of the lowest values, suggesting some other methods (especially SWTT) may provide estimates with a high bias. Regardless, the average results for both the HPT and A-DTS agree with the EVS result within a factor of 2, and all methods fall within a factor of 3 agreement envelope (see Figure ES-7). Furthermore, the event-to-event variability, as measured by the relative standard deviation (RSD) is similar for all of the methods (with EVS being the highest), ranging from 20 to 56%. This implies that the differences in methods are related more toward a systemic consistent bias rather than precision and repeatability. In practice, remediation decisions are not made from specific mass discharge values or single estimates, but rather from trends in mass discharge over time. As such, all methods appear to be reliable for this application. In most cases estimating mass discharge from several methods will increase confidence in estimated values and provide insight regarding uncertainty of the estimates. Overall, the results support the use of VWS for PFAS mass discharge estimation by multiple independent methods.

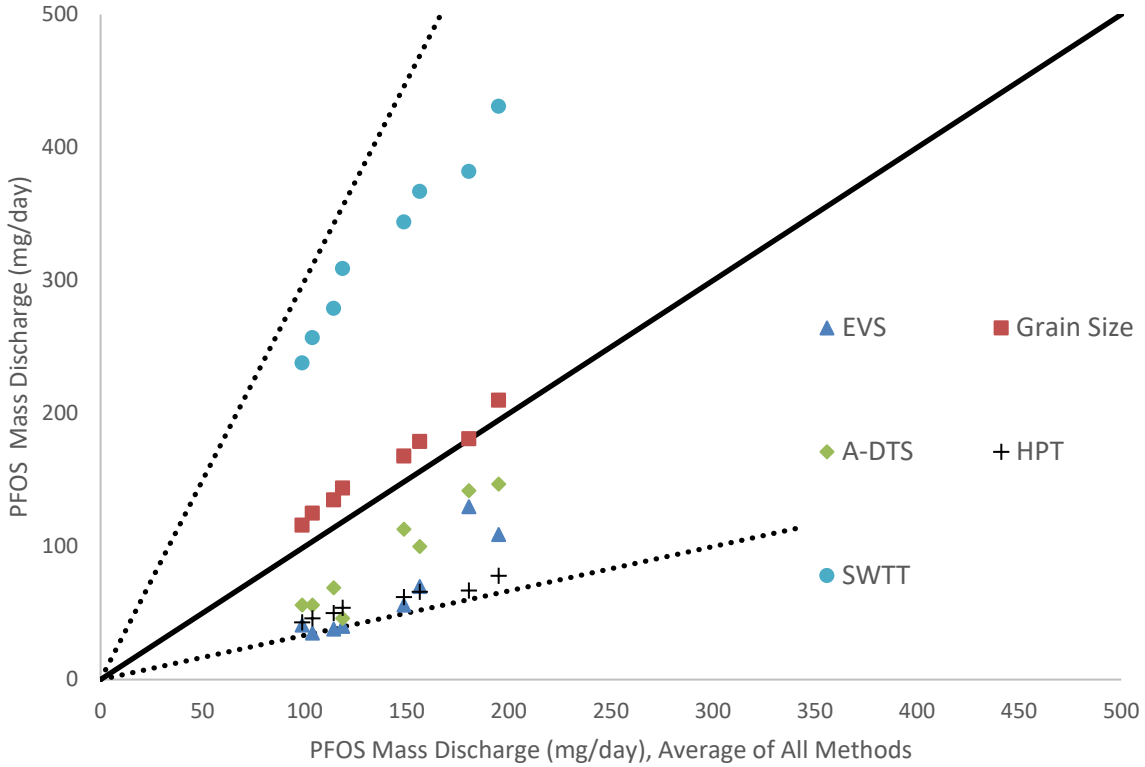



**Figure ES-7. Comparison of PFOS Mass Discharge Estimates for Each Performance Monitoring Event to the Average Value for Each Method.**

*The solid line represents 1:1 correlation and the dotted lines represent an agreement envelope of a factor of 3.*

***Quantitative Performance Objective 6: Verify Material Compatibility with Per- and Polyfluoroalkyl Substances***

This performance objective verified the expectation of PFAS compatibility based on previous published work and assessed the key components of the Vertebrate™ system that are in direct contact with sampled water.

Laboratory-based experiments were completed and focused on key VWS components including the sock polyester geotextile screen wrap, HDPE screen, and HDPE riser tubing. Specifically, rinsate experiments (passing clean water over system components to document no significant PFAS leaching) and soaking experiments (soaking key system components in a known PFAS solution to document no significant PFAS mass loss) were completed.

The criteria for this performance objective are considered achieved. No obvious signs of positive or negative bias that would affect data usability have been identified. Based on the data collected in this study, the VWSs can be tested prior to production for certification to be free of primary PFAS-type analytes. In addition, sorption of PFAS to VWS materials was measured indirectly, and the results did not indicate the VWS materials are a significant sink for PFAS. *Therefore, leaching and adsorption biases are not practical to consider as interference when using VWS and the criteria for this performance objective are considered achieved.*

***Qualitative Performance Objective 1: VWS Can Assess Contaminants and Conditions Along the Flow Path in a Longsect Configuration***

Both the absolute concentrations of PFAS species and their relative abundance (i.e., concentrations of individual PFAS species relative to each other) may change along the flow path due to PFAS transport and fate properties, geochemical conditions, and release/source mechanisms. A longsect VWS configuration that is oriented along a groundwater flow path orientation may be useful for assessing these conditions and monitoring changes through time. This performance objective is intended to assess the feasibility and usefulness of a longsect VWS configuration.

This performance objective was assessed using PFAS concentration data collected from the longsect VWS and compared to data along the flow path collected using vertical data collection methods (i.e., VAP samples and samples from multilevel and conventional wells). An eight-screen 477-foot-long VWS was successfully installed in a longsect configuration along an inferred groundwater flow path from the source area in a south-southeast direction. The average PFOS and PFOA concentrations from the longsect VWS and nearby VAP and conventional vertical monitoring wells were compared. In general, both the PFOS and PFOA data show consistency between the sampling methods and follow a general trend where the first several measurements are similar (approximately 1,100 to 2,700 ng/L for PFOS and 30 to 102 ng/L for PFOA) and then increase by more than 10 times for PFOS (up to 13875 ng/L) and more than 5 times for PFOA (up to 239 ng/L) approximately 240 feet downgradient. Concentrations then decline somewhat at 275 and 310 feet downgradient. Also, the relative concentrations of primary PFAS species along the inferred flow path distance are consistent. The generally consistency of VWS data with other sample types and the smoothness of the trend (i.e., high spatial correlation) suggest the well screens were located approximate along a common flow path and that VWS systems can be used to characterize contaminant concentrations in this way, and to assess contaminant transport processes along the flow path. *As such, the success criteria for this performance objective are considered achieved.* However, this application of VWSs will be more challenged at sites with significant geologic heterogeneity and variable flow direction.

***Qualitative Performance Objective 2: Demonstrate integrity of grout seals to isolate individual screen segments***

This performance objective is intended to confirm the integrity of the grout seals separating each well screen segment of the VWS. Seal integrity prevents groundwater from short-circuiting along the well bore and is necessary for sample quality and reliability as well as reliability of hydraulic tests in the screen intervals. Data from two independent methods were used to assess this performance objective:

A pressure transducer was inserted in VWS screen segments and water was added to adjacent screen segments to detect pressure increases from hydraulic tests in adjacent well screens. No hydraulic response was noted in individual screen segments from pressure changes in adjacent screens. The A-DTS system was used to measure temperature under passive and active (heated) conditions from the well bore. Because the different well materials (e.g., grout seals, sediments) exhibit a contrast in thermal conductivity, the position and continuity of seals along the full VWS length were mappable. Thermal response could be quantified two ways: temperature above background during curing and apparent thermal conductivity from A-DTS test.

Pressure transducer data do not show clear evidence of seal failure or poor seal construction (e.g., immediate increase in pressure greater than 1 foot of head) during injection testing in adjacent screen intervals. The A-DTS data delineate continuous seals that are at least 5 feet long (mean 13 feet, maximum 20 feet) between the five horizontal screens for the shallow VWS. *Overall, grout seals in the horizontal section appear to be placed where intended and are largely functioning as intended (hydraulic separation), as such, this performance objective is considered achieved.*

***Qualitative Performance Objective 3: Identify Challenges and Limitations of VWSs***

This performance objective aims to gather existing practical site implementation and operational considerations to help guide the design of VWSs for monitoring PFAS mass flux/discharge for other sites. Surveys from project personnel involved in installation and system operation, monitoring, sampling, and hydraulic testing were conducted to document implementation challenges or practical considerations throughout the project. Drilling and installation challenges were assessed based on site geologic and hydrogeologic conditions, and experience with the HDD required for the VWS installations.

*This performance criterion is considered successfully achieved because no significant implementation or operational challenges are identified that would limit widespread application of the VWS technology at a broad range of AFFF PFAS sites.* Key lessons learned from this field demonstration include:

- Avoid installing screens at an angle:
- Limit entry/exit angles to prevent tight bends in VWSs.
- Irresolvable uncertainty in confirming as-built vertical borehole location results in a minimum target thickness of 1 to 1.5 feet.
- Currently evaluating alternative grout delivery methods such as a mechanical seal or other means to ensure more precise placement of grout seals.
- Well materials/construction significantly affect hydraulic test results.
- Understanding seasonal water table fluctuations will be important at PFAS sites due to the potential for PFAS to accumulate near the air-water interface. VWS screens installed in high-flux zones near the water table could become dry when groundwater levels decline.

***Qualitative Performance Objective 4: Assess Robustness of the Technology***

This performance objective assesses robustness of VWS components to identify if there are design flaws or limitations that should be addressed before the VWS technology is applied at other AFFF PFAS sites. Feedback was obtained from geologists and field staff regarding observed ruggedness and performance of screens, sampling ports, connections, and other well components. Keuy responses included the following:

- Feeding sampling tubes can be challenging; dedicated tubing is recommended to simplify sampling.
- Specialty fittings are required for tracer and slug tests.

- Tight bends may inhibit flow and should be avoided where the well risers enter the well vaults.
- Based on discussion with drillers it may be possible to obtained geologic information after the pilot borehole has been installed using nuclear magnetic resonance imaging geophysical sonde that is pulled through the borehole (e.g., Spurlin et al., 2019). This could be used to confirm geologic interpretations before final VWS design and installation.

*This performance criterion is considered successfully achieved.* No fundamental design flaws/ limitations were identified, and no systemic problems were experienced during installation and sampling. As of August 2023, more than 200 VWSs have been installed. Lessons learned from previous installations and this ESTCP project will be used to continue improving the design, installation, and sampling processes.

## COST ASSESSMENT

All costs associated with design, installation, and monitoring of VWSs were tracked during the demonstration project. A simple cost model is presented in Table ES-2, below, and serves as general guidance for estimating the costs of installing VWSs. The costs do not include predesign characterization activities or performance monitoring and data analysis because their costs are highly site-specific and dependent on project objectives. For the VWS systems, the model is based on actual costs for this project and assumes three VWSs with a total length of 1,390 feet, eight screens per VWS (for a total of 24 screens), and one stand-alone horizontal fiber optic cable (for distributed temperature sensing [DTS]).

**Table ES-2. Cost Model for Installation of Three VWSs**

| Cost Element – VWS | Data Tracked During the Demonstration | Unit Cost | Unit | Quantity | Cost |
|---|---|---|---|---|---|
| Materials: VWS components | Three VWSs with total length of 1,390 feet. | $103,000 | Lump sum | 1 | $103,000 |
| | Risers and grout lines: 0.75-inch high-density polyethylene (HDPE). | | | | |
| | Well screens: 1-inch-diameter HDPE with geotextile screen. Eight screens per system for total of 24 screens. | | | | |
| | A-DTS fiber optic cables. | | | | |
| | Tracer wire: copper clad steel wire. | | | | |
| Installation of VWSs | Utility locating and surveying. | $105,000 | Lump sum | 1 | $105,000 |
| | Drilling equipment mobilization. | | | | |
| | Drilling, reaming, and well installation. | | | | |
| | Well development. | | | | |
| | Grout well seals. | | | | |
| | Flush-mount vaults. | | | | |
| Waste disposal | Waste characterization: analytical costs. | $3,000 | Lump sum | 1 | $3,000 |
| | Solid and liquid waste disposal: container rental, transportation, disposal. | $30,000 | Lump sum | 1 | $30,000 |
| **Total (VWSs only)** | | | | | **$241,000** |

The costs unique to the VWS are the well materials, with most components made of HDPE. For a typical VWS, the well materials will be roughly 50% of the installation costs (excluding waste disposal for drilling wastes). The cost of well materials have risen during the last couple of years due to high inflation rates and global supply chain issues. It is difficult to predict how material costs will change in the coming years. Most remediation professionals are already familiar with the primary factors that influence vertical drilling costs. Most of these same factors also influence costs associated with the HDD method used to install VWSs. Several variables impact VWS installation costs and each design is customized based on the objectives of the given project. The main cost drivers of the VWS technology are as follows:

- *Number of VWSs*. Unit costs for installation of a single VWS will be higher due to costs of mobilizing the directional drilling rig and associated equipment. The unit costs decrease when installing multiple VWSs.
- *Number of VWS segments and diameter*. A larger number of segments results in higher cost of well materials (dedicated riser and grout lines to each screen), additional time installing grout seals between the segments, more well development effort, and higher waste disposal costs due to the larger volume of liquid waste produced.
- *VWS length and depth*. Well length and depth have a significant impact on the overall installation costs because they strongly affect drilling and materials costs. For longer wells, larger investigation-derived waste (IDW) volumes are generated during drilling and reaming operations.
- *Lithology*. Difficult drilling conditions such as dense soils and cobbles result in slower drilling and therefore higher drilling costs. Drilling through bedrock and formations that are prone to flowing sand conditions (and resultant borehole instability) will also cause costs to increase.
- *HDD navigation*. A walkover locating system is most often used during installation of the VWSs. At some project sites, walkover locating may not be applicable due to electromagnetic interference, lack of access above the drill head, or drilling depth greater than approximately 70 feet. Expanded features for walkover tools have reduced the interference and features like drill-to-box allow some avoidance of commons interference; however, at some sites, interference can require alternatives. In these cases, a more expensive wireline navigation system would be required.

The specific requirements, scale and geometry of each application will vary. However, product capabilities and limitations can provide a typical application scenario and scalability when examining the cost. To start, drilling speed in typical lithologies is approximately 300 to 400 feet per day (ft/day). Thus, a 300- to 400-foot well system can generally be installed in 2 days (1 day for drilling and 1 day for installation and development). Well systems significantly shorter than 300 feet cannot necessarily be installed in considerably less time, and cost per foot increases appreciably. From this point of 300 feet or greater to the maximum length of typical sleeve sizes (800 to 1,200 feet) the costs are approximately linear. Beyond this distance, rig sizes and sleeve changes increase costs significantly. Also, the well screen spacing and screen length are proportional to the plume width and, at these typical spacing distances, are practical and only marginal and linear cost increases are experienced over the total distance. A typical and scalable design with an estimated drilling and materials cost of $150,000 is summarized below (oversight and IDW disposal is excluded as these are varied conditions):

- A site with sandy to silty soils with a water table depth of 10 feet.
- Two VWSs installed with 1,000 feet total of drilling, providing either stacked or multiple transect positions. A total of 20 well screen positions.
- Risers (¾ inch) for probe and tracer access, with a 4-inch sleeve.
- A 20-foot installation depth, with little to no interference for locating tools.
- Standard vaults and finishing requirements.
- Straightforward drilling conditions, with no rock or other obstructions, and standard drilling mud blends.
- Mobilization of drilling equipment within the region.

## IMPLEMENTATION CONSIDERATIONS

VWSs are most advantageous for poorly accessible plumes. The subsurface zones beneath buildings, flightlines, and other operational obstructions, including natural obstructions (e.g., ponds, forested areas) can be accessed from alternate surface positions using this technology. However, for optimal design and to maximize the performance of this technology, the following key pre-qualifications and considerations are suggested:

- The concentrations and lithology of the plume should be well-understood.
- Previous penetrations, well installations, and other vertical environmental equipment should be considered as obstacles for the VWS installation. A buffer distance between the VWS and previous penetrations is recommended at 5 feet or greater.
- Depths greater than 60 feet may require additional setbacks and larger drilling equipment. Depths greater than 100 feet likely will require additional specialized tracking equipment.
- Utilities at the beginning and end of the bore must be properly marked and at known depths anywhere the depth of the bore is less than 10 to 15 feet.
- Walkover electromagnetic drill bit locating is used along the entire bore length; however, interference often exists inside buildings and other obstacles.
- VWSs are custom built and generally require 4 to 8 weeks for processing, construction, and shipping.

# 1.0 INTRODUCTION

This Final Report describes the field deployment and performance monitoring associated with Environmental Security Technology Certification Program (ESTCP) Project ER20-5026. Points of contact (POC) information for key team members involved in the demonstration is provided in Appendix A. The objective of Project ER20-5026 is to field-validate the use of the horizontal multiport Vertebrae™ well system (VWS) for monitoring contaminant mass flux/discharge in groundwater systems. It is increasingly recognized that contaminant mass flux/discharge provides the most representative measure of plume dynamics and risk to receptors. Consequently, remedial technologies focusing on long-term mass flux/discharge reduction will be increasingly favored, and new strategies that can accurately measure changes in mass flux/discharge through time (caused by remediation activities and/or natural attenuation processes) will be more frequently implemented. Flux-focused monitoring approaches are relevant for any type of contaminant source zone but will be particularly important in the future for assessing the risk and benefits of mitigation activities for per- and polyfluoroalkyl substances (PFAS) discharging from fire training areas and other source area types (Figure 1, below).

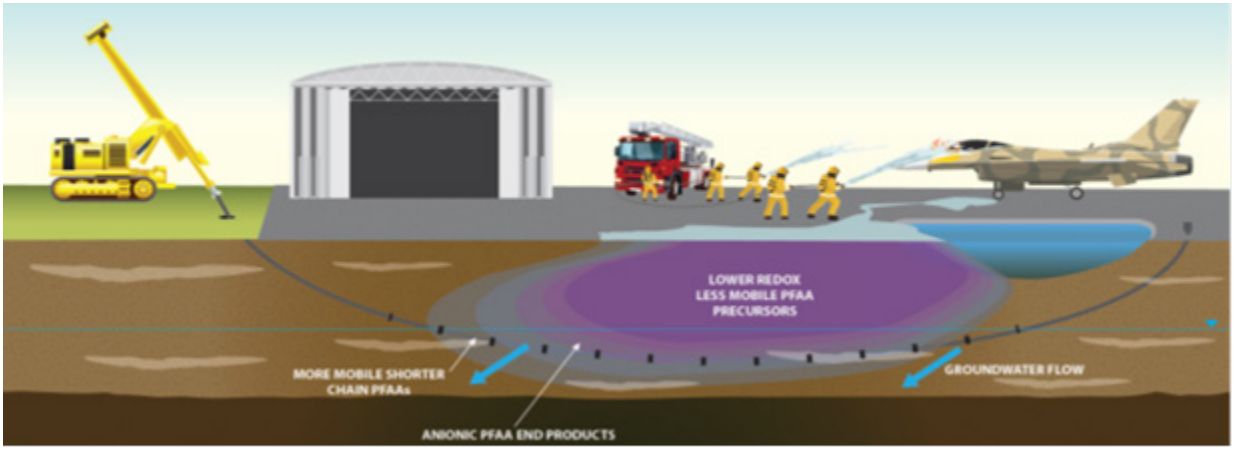



**Figure 1. Conceptual Depiction of a VWS Measuring PFAS Mass Flux/Discharge**

***The overall goal of this project is to demonstrate and validate the Vertebrae™ horizontal well system (VWS) as a technology for reliable long-term monitoring of contaminant mass flux/ discharge from PFAS source zones.***

## 1.1 BACKGROUND

The purpose and scope of this project is to demonstrate the VWS, a next-generation segmented, nested horizontal well technology (Koenigsberg et al. 2018), for monitoring changes in contaminant mass flux/discharge emanating from source zones and high-concentration areas through time. During the past decade, more than 200 VWSs have been installed in the field for general plume monitoring, remediation fluid injections, air sparging, and soil vapor extraction; however, they have not been specifically designed to monitor mass flux/discharge and have not previously been used for PFAS contaminants.

Contaminant mass flux/discharge estimation is challenging because it requires high-resolution measurements of contaminant concentrations and groundwater flux, which can be highly variable spatially due to orders of magnitude variations in concentration and hydraulic conductivity (K) in short distances. Mass flux can also vary through time due to seasonal flow system dynamics, water supply well operations, and remediation activities. Therefore, technologies that provide repeatable, high-resolution mass flux/discharge datasets that can target the important zones within heterogeneous plumes efficiently are needed to optimize remediation performance and determine when to transition to less aggressive technologies and long-term monitoring.

Of the methods that are available to measure contaminant mass flux/discharge, the transect method is probably the most insightful and commonly used because it couples with characterization (Guilbeault et al. 2005; Einarson et al. 2010; Interstate Technology & Regulatory Council [ITRC] 2010; Einarson 2017). The transect approach involves vertically drilled permanent or temporary (i.e., snapshot) installations oriented perpendicular to groundwater flow across a groundwater plume. However, this approach can be costly because it requires many individual vertical boring locations (which requires surface access) given typical high spatial variability in plumes, and many hundreds of feet of drilling with uncertainty in the horizontal direction between vertical locations. This is especially important if the target interval is relatively deep or requires high vertical resolution monitoring or sampling at each location along the transect. Direct contaminant flux approaches such as passive flux meters (Annable et al. 2005; Klammler et al. 2007) are also generally applied at high spatial resolution along transects using vertical deployments.

Further development of the application of the VWS technology will benefit the U.S. Department of Defense (DoD) and the environmental community at large because it will contribute to advancement with both cost and effectiveness in understanding contaminant mass flux/discharge in site assessment, remediation, and monitoring. In particular, the VWS will enable precise and repeatable monitoring of mass discharge with intervals oriented to intersect zones with high concentrations/flux emanating from complex source zones through time, supporting more reliable risk assessment, remedy performance assessment and optimization, and transition from active to passive remedies.

The technology is applicable to any type of groundwater contamination; however, it offers particular potential for monitoring mass discharge changes through time from PFAS sources. Scaled up across the portfolio of DoD sites, this could result in significant total remedy savings through more reliable characterization, risk assessment, flux-based decision making, and better remedy design and operation with improved performance monitoring.

## 1.2 OBJECTIVE OF THE DEMONSTRATION

The overall goal of this project was to demonstrate and validate the VWS as a technology for reliable long-term monitoring of contaminant mass flux/discharge from contaminant source zones. More specifically, this project was intended to:

- Adapt and apply mass flux/discharge methods proven for conventional vertical transect approaches to the VWS.
- Compare VWS mass flux/discharge results and changes through time to a conventional vertical transect approach.

- Potentially evaluate longsect VWS orientation to assess changes in PFAS composition along the plume flow path.
- Develop guidance regarding the VWS technology application, limitations, anticipated performance, design considerations, and cost.

## 1.3 REGULATORY DRIVERS

It is increasingly apparent that contaminant mass flux and mass discharge represent the most appropriate measure of plume dynamics and risk to receptors. Consequently, remedial technologies focusing on long-term mass flux/discharge reduction will be increasingly favored, and Strategic Environmental Research and Development Program (SERDP) and ESTCP have funded numerous projects to develop flux-focused characterization and remediation techniques. New strategies that can be used to more accurately measure changes in mass flux/discharge through time will be developed and more frequently implemented in the future (Klammler et al. 2007; Suthersan et al. 2010; Acar et al. 2013; Klammler et al. 2016; Horneman et al. 2017; Horst et al. 2022; Divine et al. 2023). In 2018 and 2022, SERDP and ESTCP hosted strategic workshops attended by personnel representing DoD remedial program managers, federal and state regulators, academic researchers, industry representatives, and consultants focused on the remaining challenges for chlorinated solvent and PFAS remediation. The summary reports from these workshops (SERDP and ESTCP 2018, 2022) identify methods for evaluating mass discharge to support closure as a critical demonstration need, noting:

> *"Mass discharge data can provide considerable insight into the benefits of remediation efforts, the strength of residual sources, and the risks to downgradient receptors of concern. The results can be valuable in prioritizing residual sources for further treatment, evaluating whether to transition to MNA, or whether site closure is warranted. There is a need to develop and demonstrate methods and approaches to characterize the mass discharge of contaminants from residual sources and use that information to make a robust evaluation of the risk posed by the residual source to groundwater quality near source areas and to downgradient receptors."* (SERDP and ESTCP 2018)*."*[1]

As noted by Anderson (2021), many regulatory agencies are currently publishing criteria intended to define the nature and extent of PFAS-impacted environmental media. However, the simplfying assumptions supporting the calculation of some of these screening values may not appropriately reflect multiple complex and rate-limited processes (e.g., hydrophobic interactions with soil organic carbon, electrostatic interactions with the surfaces of clay minerals, and air-water interfacial accumulation) controlling PFAS transport, particulary in the vadoze zone near source areas and within the capillary fringe. Because reliable simulation of PFAS transport in field settings appears to require complex multiprocess kinetic models with multiple input parameters that will be difficut to constrain, reliable methods for long-term monitoring of PFAS mass flux/dischare will be required at many sites to assess risk, determine remediation enpoints, and assess remedy performance (SERDP and ESTCP 2022; Horst et al. 2022).

[1] MNA = monitored natural attenuation.

# 2.0 TECHNOLOGY

This section provides an overview of the VWS, which has been deployed at more than 70 sites. The focus for this project is its use for long-term monitoring of PFAS mass flux/discharge in groundwater, which is a new and unique application for this technology.

## 2.1 TECHNOLOGY DESCRIPTION

The VWS is a single, small-diameter horizontal well that contains multiple isolated screen segments; essentially, it is an engineered multiport well that is installed horizontally instead of vertically (Figure 2, below). The VWS can provide another transect method option, as a complement or alternative to the conventional vertical transect option. The VWS is unique, with many discrete screen zones running horizontally along its length and separate, small-diameter tubing plumbed from each screen to the surface. Grout, which is tremied in, is used to isolate the individual tailor-designed screen intervals. The VWS technology can be applied as a variation of the conventional transect approach. The difference is the monitoring points are installed horizontally instead of vertically, with improved coverage along the width of the plume at targeted depths with highest concentrations or flux, but with generally lower vertical resolution due to practical limits on placing multiple systems at different depths. The VWS approach is novel and advantageous because multiple closely spaced measuring points across a transect can be easily installed from a single boring (reducing costs) and contaminant zones that may have been previously inaccessible via vertical boreholes can be characterized. Currently, detailed geologic information is not readily available during the drilling process; therefore, an accurate understanding of contaminant distribution within the site hydrostratigraphy from high-resolution characterization using vertical borings/profiles is required to optimize placement of the horizontal wells and to select target intervals for the monitoring zones.

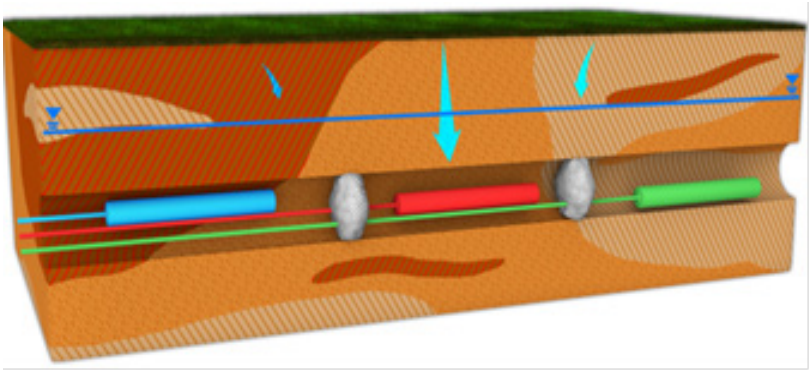


**Figure 2. VWS**

*The VWS contains multiple screen segments separated by grout seals with independent connections to the surface. It can be thought of as a nested well installed horizontally.*

The conventional transect method for characterizing contaminant mass flux relies on a series of temporary or permanent vertical monitoring points providing data in vertical profiles along a transect across the entire plume, perpendicular to groundwater flow (ITRC 2010). The monitoring points are sampled to provide concentration data across the control plane at appropriate lateral and vertical spacing to capture the plume concentration distribution.

An appropriate method for measuring groundwater flux at similar high resolution is also required and the combined groundwater concentration and flux data are used to assess contaminant mass flux/discharge across the transect (note: this does not capture sorbed mass within the plume, which can be significant in many lithologies and relevant to site management decisions).

VWSs are installed using horizontal directional drilling (HDD), which is a mud rotary drilling process that uses a specialized rig and asymmetric bit to drill a curved borehole along a pre-determined bore path and the prefabricated VWS is pulled into the borehole (Figure 3, below). The VWS is a multiport horizontal well that has been installed with as many as 18 discrete screen zones; however, these values are not upper limits because additional screened zones are feasible. To date, VWS wells exceeding 900 feet long and 45 feet deep have been installed, but longer and deeper wells with currently available drilling technology are feasible.

The VWS can be thought of as a nested well installed horizontally instead of vertically. Individual screen lengths range from 3 to 30 feet with separate 0.5- to 1.5-inch-diameter tubing plumbed from each screen to the surface. Multiposition monitoring along horizontal paths can be more efficient because it is aligned with hydrologically significant zones within and at the boundaries of aquifers parallel to layering typical of sedimentary facies. Grout is used to isolate the individual screen intervals within the horizontal well (Figure 2, above). EN Rx, Inc. (EN Rx) has developed a proprietary grout seal mixture to increase elasticity, longevity, and sealing efficiency to isolate the intervals in each horizontal boring. The VWS is compatible with all common contaminant types and has been used at sites with petroleum hydrocarbons, chlorinated solvents, metals, and high salinity. This was the first site where the VWS was deployed for monitoring PFAS. Prior to installation, all well system components were demonstrated to be PFAS-free (further discussed in Section 7.6 as part of Quantitative Performance Objective #6).



**Figure 3. Installation of VWS**

*Left: Horizontal directional drilling and mud pit. Middle: Asymmetric drill bit. Right: Preconstructed VWS immediately prior to pullback into the borehole.*

## 2.2 TECHNOLOGY DEVELOPMENT

During the past two decades, HDD methods have been used in a wide range of environmental applications and the drilling technology has been completely developed and is readily available throughout the United States. Lubrecht (2012) highlights some of these applications and notes some key sustainability advantages of HDD compared to conventional vertical drilling techniques.

The VWS, which is a patented technology developed by EN Rx, was first implemented in a field application for remediation agent injection purposes in 2014 and the first system used to collect groundwater quality data as a monitoring system was completed in 2015. To date, more than 205 VWSs have been deployed at more than 70 sites in a wide range of geologic settings in which more than 1,100 individual wells (separate screen intervals) were installed. The wells were installed to characterize contaminant distribution and support remediation. VWSs have not previously been used to quantify contaminant mass flux/discharge; this project was specifically intended to demonstrate and validate this application. No technology development was conducted under the ESTCP project prior to the field demonstration.

## 2.3 ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY

Compared to vertical wells, horizontal wells offer several notable advantages in environmental remediation applications, as detailed by others (Lubrecht 2012; Koenigsberg et al. 2018; Divine et al. 2018a, 2018b; Laton 2019). Horizontal wells can be readily installed and operated under buildings, roads, flight lines, and other surface infrastructure, and therefore represent minimal potential to impact facility operations during installation and sampling. Horizontal wells can be designed to target precise elevations and laterally continuous high-permeability zones in the horizontal plane (e.g., sand layers). VWS wells can be constructed with up to approximately 20 individual and separate well screen segments separated by as little as 10 feet, allowing high spatial resolution of groundwater concentrations and surgical targeting of treatment zones. Based on reasonable assumptions, a single VWS may be more cost effective than multiple conventional vertical wells when the total number of targeted sampling intervals is more than six to eight for common site conditions.

One of the most important limitations with the VWS technology is that it is not a primary characterization technology because lithologic information is not obtained during directional drilling. Therefore, optimal design of VWSs requires pre-characterization with high-resolution vertical techniques to select the target depths and zones for horizontal screen placements. Heterogeneous lithologies with highly interbedded or discontinuous flux zones may present site-specific implementation challenges. For many sites, it may only be practical to install VWSs at no more than three different depth intervals along a transect, which may limit the amount of vertical characterization possible for complex plumes. Further, understanding seasonal water table fluctuations is important because a decline in groundwater elevation during a dry period could result in a VWS well installed near the water table going dry. This is an important consideration due to the potential for PFAS to accumulate near the capillary fringe because many PFAS tend to accumulate at air-water interfaces (Brusseau 2021; Brusseau and Guo 2022). Additional potential complications that may be encountered during implementation that must be considered include electromagnetic interference with walkover locating borehole navigation system and the inadvertent drilling fluid returns to ground surface along preferential pathways. Qualitative Performance Objective #3 (further discussed in the Section 7.9) was specifically intended to identify challenges and limitations, and associated mitigation measures.

# 3.0 PERFORMANCE OBJECTIVES

Multiple VWSs, each comprising multiple sampling ports at discrete intervals, were installed at a DoD site where monitoring contaminant mass discharge from a PFAS source zone is a priority. Two VWSs were installed transverse to groundwater flow (i.e., transects) downgradient of a PFAS source area. These transverse alignments were located at the same lateral distance from the source area but at two different depth intervals. An additional application was tested with the orientation of a VWS parallel to groundwater flow (i.e., longsect) to measure changes in contaminant characteristics along the contaminant flow path (i.e., plume centerline) within a continuous hydrostratigraphic zone.

Quantitative and qualitative performance objectives were established in the Demonstration Plan (Divine et al. 2021c) to provide the basis for evaluating the performance and costs of the VWS technology. The specific performance objectives, criteria that were used to evaluate success, and a summary of the results are presented in Table 1, below. Detailed evaluations of each performance objective are presented in Section 7 Performance Assessment.

**Table 1. Performance Objectives**

| Performance Objective | Data Requirements | Success Criteria | Success Criteria Achieved? |
|---|---|---|---|
| **Quantitative Objectives** | | | |
| 1. Accurate and reliable placement of screens in subsurface. | Bore-path drilling navigation data, and post-installation geophysical survey data. | Eighty percent (%) of all drilling navigation data agree within 1.5 foot (elevation) of the bore path elevation and 80% of the as-built data agree within 1.5 foot of the planned target depth elevations. | **Yes** Six of six screens along horizontal section were within 1.5 vertical feet of the target elevations and positions. |
| 2. Validate methods for groundwater flux measurement with VWSs. | Hydraulic conductivity, hydraulic gradient, tracer test data, active fiber optic distributed temperature sensing (A-DTS) data. | Complete successful field testing of methods. For each method estimates that are repeatable (±25%) and agree with the averages from all the methods within 25% according to an analysis of variance statistical test (within 25% at an 80% confidence). | **Yes** Both the A-DTS and single-well tracer test (SWTT) methods are considered to have achieved success for this performance objective, based on modified criteria. |
| 3. Assess comparability of samples collected from VWS screens to grab samples. | Concentration data from VWS screens and co-located vertical cores/wells or groundwater grab samples. | Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) concentrations measured from the VWS screens agree within 1 order of magnitude for at least 75% of co-located grab samples. | **Yes** Sample results from the VWS are consistent with conventional sampling methods. |

## Table 1. Performance Objectives (Continued)

| Performance Objective | Data Requirements | Success Criteria | Success Criteria Achieved? |
|---|---|---|---|
| 4. Demonstrate method to identify appropriate mass flux zones to target VWS placement. | All currently existing hydraulic, hydraulic profile tool, and groundwater grab sample concentration data as well as additional high-resolution data developed during the pre-design investigation. | Achieved if a relationship between pre-design data availability and the predicted mass discharge measured from the resulting VWS designs can be developed, and if this relationship indicates the VWS design will yield a mass discharge estimate within ±25% of the estimated derived from other data. Related guidance for design of VWS from site data will be developed. | **Partially** A clear relationship between data used and the calculated mass discharge was developed via a practical method. However, the analysis did not yield results that agreed within ±25% |
| 5. Validate VWS application for quantifying mass flux/discharge along transects. | Mass flux/discharge estimates normal to groundwater flow for VWSs and conventional vertical borings/ wells installed along a nearby transect. These estimates will be derived from PFAS concentration data and darcy flux values determined from hydraulic testing, tracer testing, the A-DTS. | Mass flux/discharge estimates with VWSs agree with conventional approaches within 25% with equal or lower uncertainty estimated through propagation of uncertainty statistical techniques. | **Yes** None of the methods meet this statistical level, however, this may have been an unrealistic success criterion. The average results for both the HPT and DTS agree with the EVS result within an order of magnitude and event-to-event variability is similar for all of the methods. This implies that the differences in methods are related more toward a systemic consistent bias rather than precision and repeatability. Consequently, the results support the use of VWS for PFAS mass discharge estimation. |
| 6. Verify materials' compatibility with PFAS. | Rinsate blank and PFAS stock solution samples after contact with VWS components. | PFOS and PFOA are less than the United States Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs) of 4.0 nanograms per liter in rinsate blank samples and PFAS loss from the sample due to sorption to well materials is less than 10% or the analytical precision (whichever is greater) for each tested compound. | **Yes** The VWSs can be tested prior to production for certification to be free of primary PFAS analytes. |

## Table 1. Performance Objectives (Continued)

| Performance Objective | Data Requirements | Success Criteria | Success Criteria Achieved? |
|---|---|---|---|
| **Qualitative Objectives** | | | |
| 1. VWS can assess contaminants and conditions along the flow path in a longsect configuration. | Contaminant concentrations data from longsect VWS, monitoring wells, and vertical aquifer profile samples. | PFAS concentration data collected from different screen intervals located progressively downgradient follow discernable and consistent trends, indicating the samples represent locations along a constant flow path. | **Yes** Samples from the VWS were generally consistent with other sample types and exhibited high spatial correlation. |
| 2. Demonstrate integrity of grout seals to isolate individual screen segments. | Pressure data from injection tests and A-DTS temperature data measured under passive and active (heated) conditions. | Pressure data do not show clear evidence of seal failure and A-DTS data delineate continuous seals that are at least 5 feet long between each well screen. | **Yes** Grout seals in the horizontal section are placed where intended and are largely functioning as intended (hydraulic separation). |
| 3. Identify challenges and limitations of VWSs. | Feedback from drillers, installation, and monitoring personnel and project technical staff. | Challenges and limitations are understood and can be readily mitigated. | **Yes** No implementation or operational challenges were identified that would limit widespread application. |
| 4. Assess robustness of the technology. | Feedback from geologists and field staff regarding observed ruggedness and performance of screens, sampling ports, connections, and other well components. | No fundamental design flaws/limitations identified, and no systemic problems experienced during installation and sampling. | **Yes.** |

# 4.0 SITE SELECTION AND DESCRIPTION

Based on the evaluation presented in the Site Selection Memorandum (Divine et al. 2021a), the field demonstration was performed at Grayling Army Airfield (GAAF) in Grayling, Michigan. The combination of site characteristics, previous PFAS characterization, and synergy with the planned remedial investigation (RI) meet the requirements of the demonstration and provide value to the Army National Guard (ARNG) in evaluating the source and nature of the highest PFAS concentrations migrating off site. The mass-flux-based conceptual site model (CSM) will aid in developing future remedy strategies. It is possible that the VWSs could be used to evaluate performance of future technology demonstrations designed to treat the soils and groundwater in this area. Site selection screening criteria presented in Table 2, below, are based on the features and requirements of the VWS and the performance objectives of the demonstration.

**Table 2. Site Selection Screening Criteria**

| Screening Criteria | GAAF |
|---|---|
| Well-characterized PFAS source and plume with high-resolution site characterization (HRSC) data | RI activities initiated in 2019 resulted in a sound CSM and will continue to generate additional relevant data. |
| Previous mass flux/discharge evaluation completed | Detailed mass flux estimate completed as part of ESTCP project ER19-5203. |
| Total PFAS concentrations are relatively high, with several different PFAS constituents present | At least nine PFAS constituents detected in groundwater with total PFAS concentrations exceeding 30 micrograms per liter (µg/L). |
| Aquifer is shallow (plume depth less than 60 feet preferred), relatively permeable, with low variability in K values | Depth to water is 12 to 15 feet below ground surface (bgs). The aquifer exhibits generally low heterogeneity, with K values typically ranging from 30 to 75 ft/day, with some zones that may exceed 200 ft/day. |
| Unconsolidated geologic setting amenable to direct-push techniques for vertical characterization | Unconsolidated glacial sediments. Prior direct-push investigations completed (ESTCP ER19-5203). |
| Ideal if mitigation actions have recently been completed or are likely soon to be implemented | Future source area mitigation actions likely. |
| Straightforward drill rig access | No access limitations. |
| Engaged/supportive regulatory agency and stakeholders | Very supportive. Stakeholders strongly desire the demonstration and believe the results will support the current RI and aid in future decision making and performance monitoring. |

The VWS is appropriate for any contaminant type and has significant potential for chlorinated solvent and PFAS sites. With the DoD's current priority of developing methods to assess risks associated with PFAS discharging from fire training areas, it was recommended that the field demonstration be completed at a PFAS site. Further, although the VWS technology is suited for installation below surface obstructions, for this demonstration the source and plume areas of interest (AOIs) were unobstructed so that transects of vertical cores and application of direct-push profiling methods to inform multilevel well positions could be installed for comparison/validation purposes.

## 4.1 SITE LOCATION AND HISTORY

Camp Grayling is located approximately 200 miles northwest of Detroit, Michigan in the north-central portion of the Lower Peninsula and approximately 80 miles south of Michigan's Upper Peninsula (Figure 4, below). It is the main training facility for the Michigan National Guard and is the Army National Guard's largest facility. The facility occupies 147,000 acres and is divided into North and South Post operational areas.

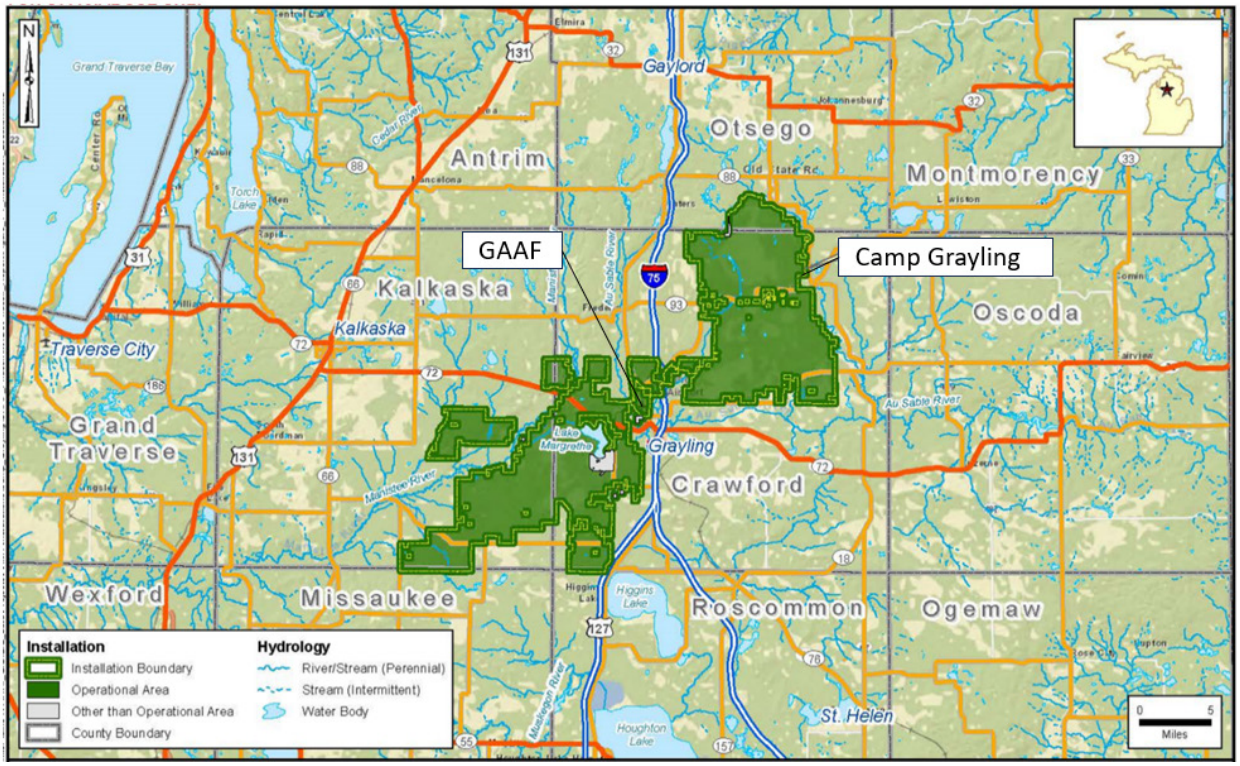



**Figure 4. Location of Camp Grayling**

The focus of this field demonstration was the GAAF (Figure 5, below). The GAAF is located between the North and South Posts of Camp Grayling and has been operational since 1942. The GAAF is located immediately west and northwest of the city of Grayling, at the intersection of I-75 and North Down River Road West and covers 923 acres of state and federally owned property. The general geographic coordinates for the center of the airfield are 44°40′49″N; 84°43′44″W. The GAAF has two runways, and facility access is restricted by controlled gates. The GAAF has support buildings and facilities along its eastern boundary including a control tower, barracks, vehicle storage, and the Camp Grayling Fire Department. The former location of the Camp Grayling Maneuver Area Training Equipment Site (MATES) is on the southwestern portion of the airfield, which is now known as the Former Bulk Fuel Storage Area. The former MATES was historically served by railroad tracks running along the western boundary of the airfield (AECOM 2019).

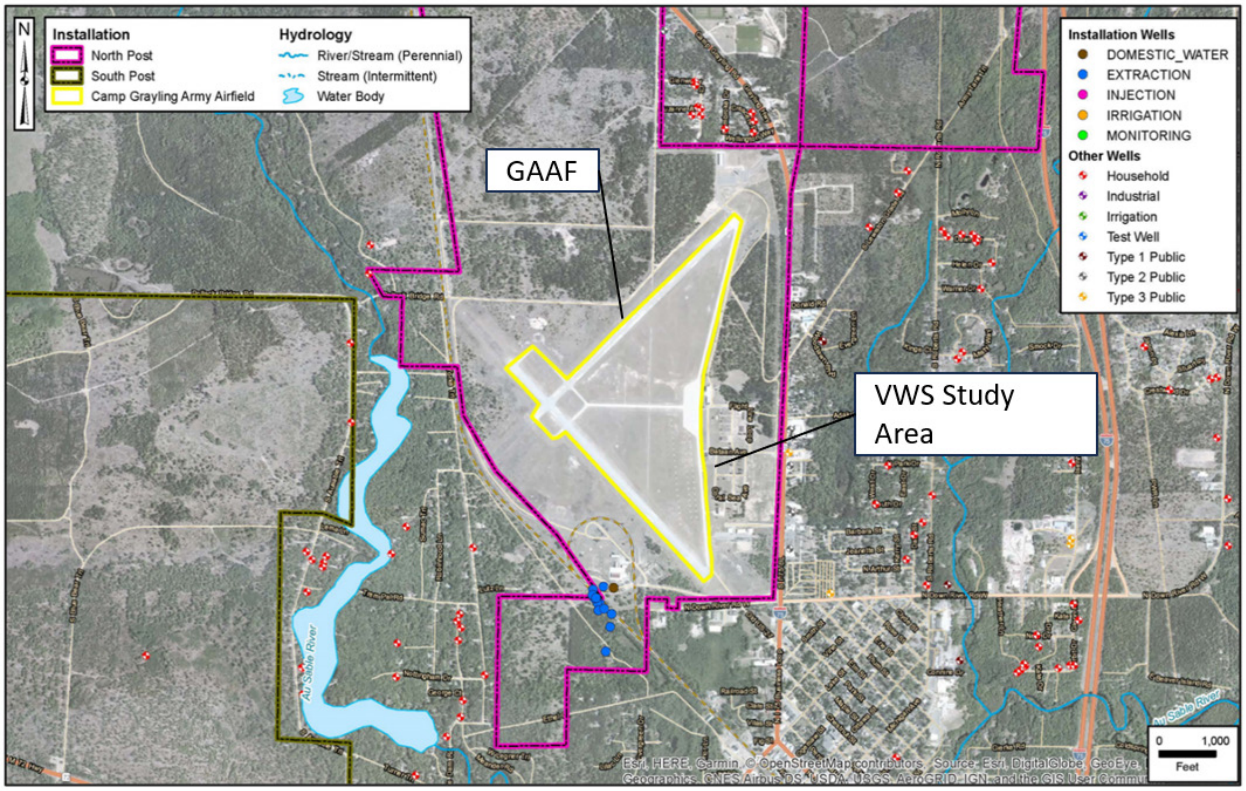



**Figure 5. GAAF**

The predominant land use outside the camp boundaries is public lands, primarily forested. Private lands and residences abut portions of the GAAF, including the city of Grayling, located southeast of the GAAF. Seasonal and permanent residences are present along the banks of the Au Sable River and Lake Margrethe, and both waterbodies are used for recreational activities (e.g., swimming, canoeing, fishing). The city of Grayling and Grayling Township have light industrial and heavy industrial zoning. Reasonably anticipated future land use is not expected to change from the current land use described above (AECOM 2018).

## 4.2 SITE GEOLOGY AND HYDROGEOLOGY

The geology at the GAAF consists of unconsolidated glacial sediments underlain by bedrock from the Coldwater and Michigan Formations. Glacial sediments consisting of sand and gravel outwash plains, lacustrine clay, and glacial till are reported to extend to at least 600 feet bgs. Fluvial deposits associated with the Au Sable River are also present at GAAF (AECOM 2018). Soil borings completed to a depth of 60 feet bgs show soils consisting of well-sorted sand and gravels with discontinuous silty sand layers (AECOM 2018; Figure 6, below). Lenses of clay are also encountered throughout the southeast corner of the GAAF.



**Figure 6. Photographs of Drill Core (Collected from 15 to 20 bgs; left) and Excavation Cut (Right) at the GAAF**

*These images show the relatively coarse and uniform grain size characteristics of the shallow soils at the GAAF.*

Regional and local groundwater flow appears to generally follow surface water drainage patterns. Regional groundwater divides most likely correlate to the major surface water divides for the Manistee, Au Sable, and Muskegon Rivers. The GAAF is located between the main stem and East Branch of the Au Sable River. Groundwater occurs at depths of approximately 6 to 15 feet bgs in unconfined sandy aquifers. A groundwater potentiometric surface map (Figure 7, below) suggests that apparent average groundwater flow direction within the GAAF is southerly, turning southeasterly in the southeast portion of the GAAF toward the East Branch of the Au Sable.

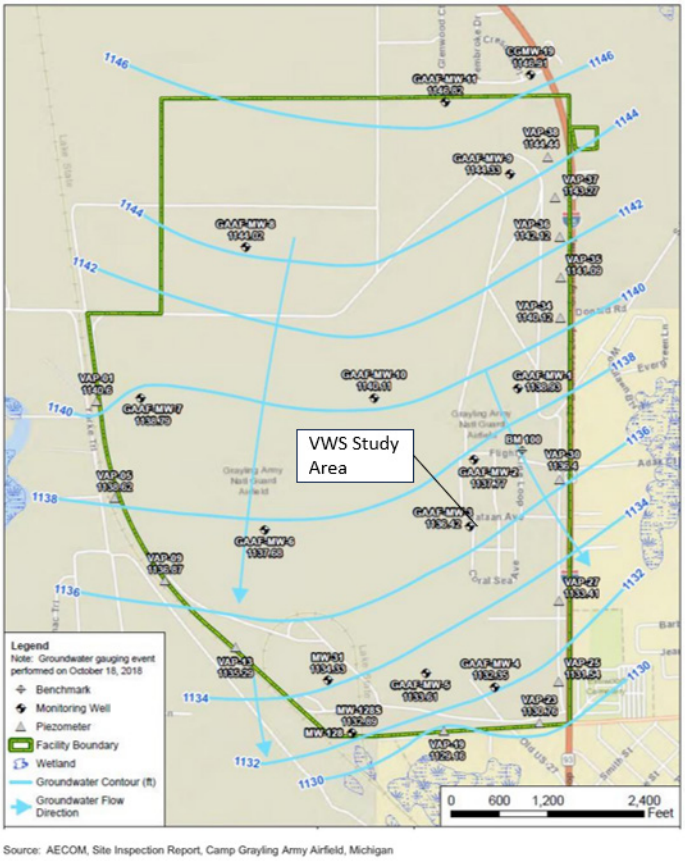



**Figure 7. GAAF Groundwater Elevation Contour Map**

## 4.3 PREVIOUS PER- AND POLYFLUOROALKYL SUBSTANCES CHARACTERIZATION

This section summarizes the PFAS characterization activities that were conducted prior to this ESTCP demonstration.

### 4.3.1 2017 to 2018 Site Investigations

A PFAS investigation was conducted in 2017 by the Michigan Department of Military and Veteran Affairs in the area of the Former Bulk Fuel Storage Area. This area (formerly referred to as the MATES) has an inactive groundwater pump and treatment system (air stripper) to remediate a tetrachloroethylene and trichloroethylene plume and includes a network of monitoring wells associated with the remediation system. The PFAS investigation was conducted in the area of the inactive treatment system and along the site boundary. Based on vertical aquifer profile (VAP) groundwater samples collected along the site boundary, the sum of PFOS and PFOA concentrations detected in VAP samples exceeded the then-current USEPA Health Advisory Limit (HAL) of 70 nanograms per liter (ng/L) at six locations spanning the southern portion of the eastern site perimeter, with the highest concentrations focused at VAP-27 (perfluorooctane sulfonate [PFOS]/ perfluorooctanoic acid [PFOA]: 2,650 ng/L), with concentrations an order of magnitude less to the north and south of VAP-27 (AMEC Foster Wheeler 2017).

Beginning in 2017, the Michigan Department of Environmental Quality (MDEQ) conducted residential drinking water well sampling, which to date has identified 17 wells with concentrations that exceed the USEPA HAL.

In 2018, AECOM conducted a preliminary assessment (PA) to identify and assess potential PFAS release areas at Camp Grayling, including the GAAF. Five AOIs were identified for the GAAF during the PA where PFOS/PFOA in the form of aqueous film-forming foam (AFFF) had been used or had been historically released (AECOM 2018).

In 2018, a site inspection (SI) was conducted to assess the AOIs identified in the PA. In the southeast portion of the GAAF, upgradient of VAP-27, the SI identified PFOS concentrations of 27 and 74 micrograms per kilogram (µg/kg) in vadose zone soil samples collected on the west side of Building 1160, as well as a PFOS concentration of 344 ng/L in groundwater on the east side of Building 1160 (AECOM 2019). Relatively low concentrations of PFOS (2 to 13 µg/kg) were detected in soil on the east side of Building 1195; however, PFOS concentrations in groundwater samples from this area were less than laboratory detection limits (AECOM 2019).

### 4.3.2 Environmental Security Technology Certification Program 2019 Mobile Lab Demonstration and Mass Flux Assessment

In 2019, an ESTCP demonstration project (ER19-5203; Arcadis U.S., Inc. [Arcadis] 2020) was completed to validate the application of real-time mobile laboratory methods for characterization of PFAS sources and associated groundwater plumes. The overarching goal for the analytical chemistry work was to demonstrate that PFAS mobile laboratory methods can be applied in the field to provide near real-time characterization data, allowing adaptive delineation and development of flux-based CSMs.

The mobile laboratory was deployed as part of an adaptive investigation for the southeast portion of the GAAF. The investigation focused on the area associated with two identified AFFF source areas identified at Buildings 1160 and 1194/95. The stratigraphic flux approach (Arcadis 2017) was applied on site, combining real-time high-resolution measurements of stratigraphy and permeability with high-frequency soil and groundwater sampling to focus on characterizing source strength, contaminant leaching, and downgradient mass movement. Validation of the mobile laboratory included adaptive high-frequency soil and groundwater sampling in the source areas (Buildings 1160 and 1194/95) and on transects downgradient progressing toward the southeast site perimeter and boring VAP-27.

The investigation included initially planned borings designated as "primary" and additional borings designated as "adaptive" based on the real-time analytical results. High-resolution permeability measurements were completed using the Geoprobe® hydraulic profile tool (HPT) and were compared to soil descriptions and to K derived from correlation equations based on soil grain-size analysis.

The final locations of the source areas and scope of work for each boring are shown on Figure 8, below. The components of the investigation were as follows:

- Three primary source borings installed immediately downgradient of each of the two potential source areas (Buildings 1160 and 1194/95). Soil samples were collected from the capillary fringe, at the water table, and just below the water table. Groundwater samples were collected via 1-inch-diameter polyvinyl chloride (PVC) temporary monitoring wells with 5-foot-long screens.
- Three adaptive flux transects spaced downgradient of the two potential source areas and upgradient of the highest PFAS concentration area identified at the site perimeter during previous site characterization (VAP-27). Transect locations were completed using HPT borings, VAP sampling, and soil logging and sampling.
- Six secondary source borings completed near Building 1160 to provide greater resolution of source area impacts. Secondary source locations were completed using HPT borings and soil logging and sampling. In addition, VAP groundwater samples were collected below the Building 1160 source area.
- Installation of four lysimeters and synthetic precipitation leaching procedure sampling to characterize soil moisture and contaminant loading in the source vadose zone.

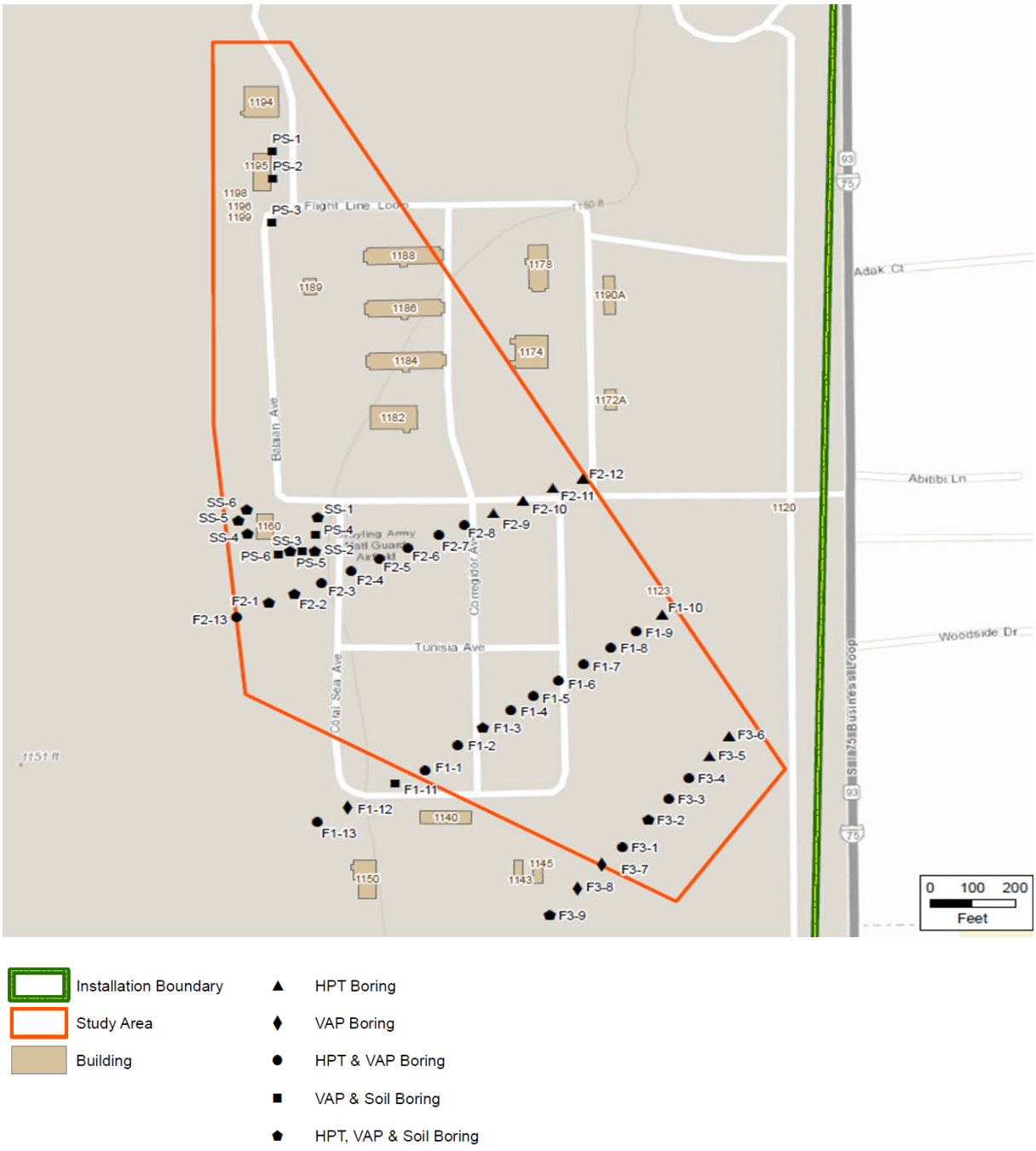



**Figure 8. HPT Boring and VAP Locations at GAAF Completed as Part of ESTCP Project ER19-5203**

Of the PFAS detected at the GAAF, PFOS is dominant in soil and groundwater and was generally detected at concentrations 1 to 2 orders of magnitude greater than perfluorohexanesulfonic acid (PFHxS), PFOA and other PFAS. Rather than focus on delineation, the objective of this project was to define source strength (primarily associated with Building 1160) and identify the primary zones of mass flux downgradient of the source areas along the three HPT/VAP transects.

As the investigation progressed, and based on the mobile laboratory results, the focus of the investigation shifted to Building 1160. In general, the proximity of Building 1160 provided a clearer correlation of source concentration to downgradient mass flux. Only the primary borings were completed at Building 1194/95.

The highest PFOS concentrations in soil at Building 1160 were observed in vadose zone and capillary fringe soils in soil borings SS-4, SS-5, and SS-6, located on the west side of Building 1160 in the area associated with former fire truck parking. The highest concentrations of PFOS were observed in vadose zone soils, up to 560,000 nanograms per kilogram (ng/kg), at a depth of 5.5 to 6.0 feet bgs at boring SS-6. Elevated concentrations were also observed at the capillary fringe and just below the water table with total concentrations (soil/groundwater) up to 95,000 ng/kg at boring SS-5. The PFOA concentrations were typically 2 to 3 orders of magnitude less than PFOS at Building 1160, with a maximum concentration in soil of 9,100 ng/kg detected at a depth of 3.5 to 4.0 feet bgs at boring SS-5. Concentrations of both PFOS and PFOA are significantly less in soils to the east of Building 1160.

Concentrations in groundwater beneath the Building 1160 source area were highest at the water table, with a maximum PFOS concentration of 2,400, 800, and 2,100 ng/L at borings SS-4, SS-5, and SS-6, respectively. Groundwater concentrations within the Building 1160 plume core increase downgradient, with PFOS up to 31,000 ng/L at Transect 2, located 250 feet southeast of the Building 1160 source area. At Transect 1 located 500 feet further to the southeast, PFOS concentrations up to 30,000 ng/L were measured within the Building 1160 plume core. The primary borings at Building 1194/95 were completed downgradient of the reported fire truck parking area, to the east/southeast of Building 1195. PFOS was detected in saturated soil at a maximum concentration of 66,000 ng/kg just below the water table (16.5 to 17.0 feet bgs) at soil boring PS-1. PFOA was not detected in soils at Building 1194/95. Shallow groundwater concentrations east of Building 1194/95 indicate PFOS concentrations of 7,200, 9,600, and 4,500 ng/L at borings PS-1, PS-2, and PS-3, respectively. Concentrations of PFOA in groundwater were 1 order of magnitude less, with corresponding concentrations of 130, 110, and 170 ng/L, respectively. Based on the concentration distribution, two comingled groundwater plumes were interpreted at Transects 1, 2, and 3, with concentrations of PFOS up to 10,000 ng/L likely attributed to the Building 1194/95 source area.

For the GAAF, the high-resolution permeability data and estimated K values obtained with the HPT and concentration data collected from VAP borings were evaluated using the three-dimensional (3-D) model Earth Volumetric Studio (EVS; C Tech Development Corporation, Las Vegas, Nevada) to facilitate mass flux evaluation. The three transects at the GAAF were modeled independently to provide a 3-D evaluation of mass flux and mass discharge along successive planes within the aquifer. This approach provided insight to mass movement, plume maturity, and plume morphology, allowing for future evaluation of remedy approach, location, design, and performance assessment. The nodal data from the mass flux model were summed to estimate the total mass discharge along each transect. The mass flux distribution is shown on Figure 9 (all three transects) and Figure 10 (Transect 1), below. A summary of mass discharge previously estimated for PFOS and PFOA is presented in Table 3, below.

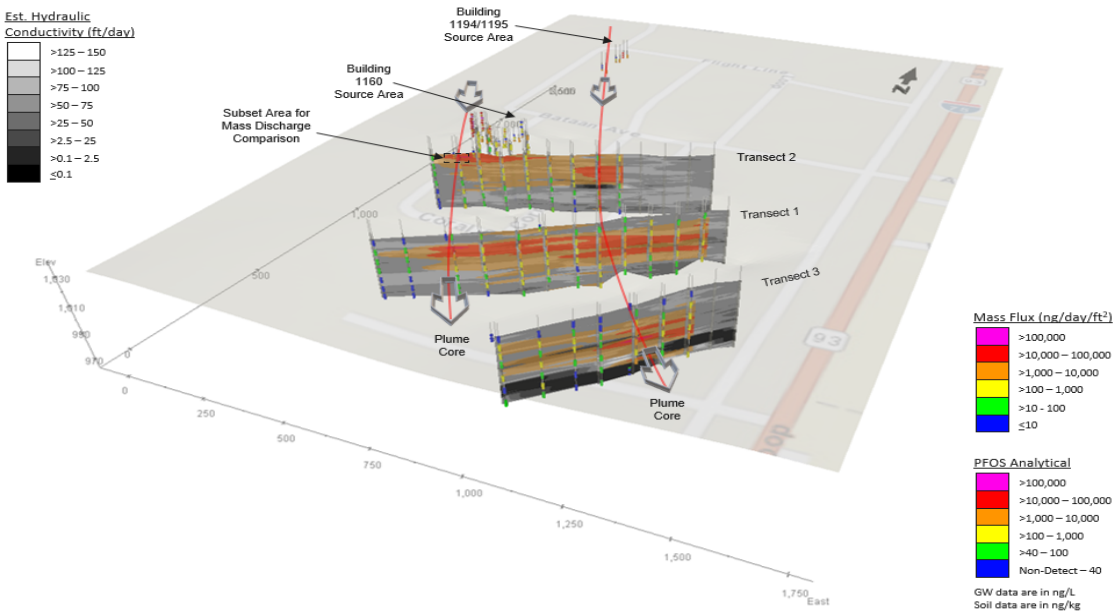



**Figure 9. Previous Estimated Hydraulic Conductivity Values and Estimated PFOS Mass Flux at Three Transects at GAAF Completed as Part of ESTCP Project ER19-5203 and Based on Data Collected in 2019**

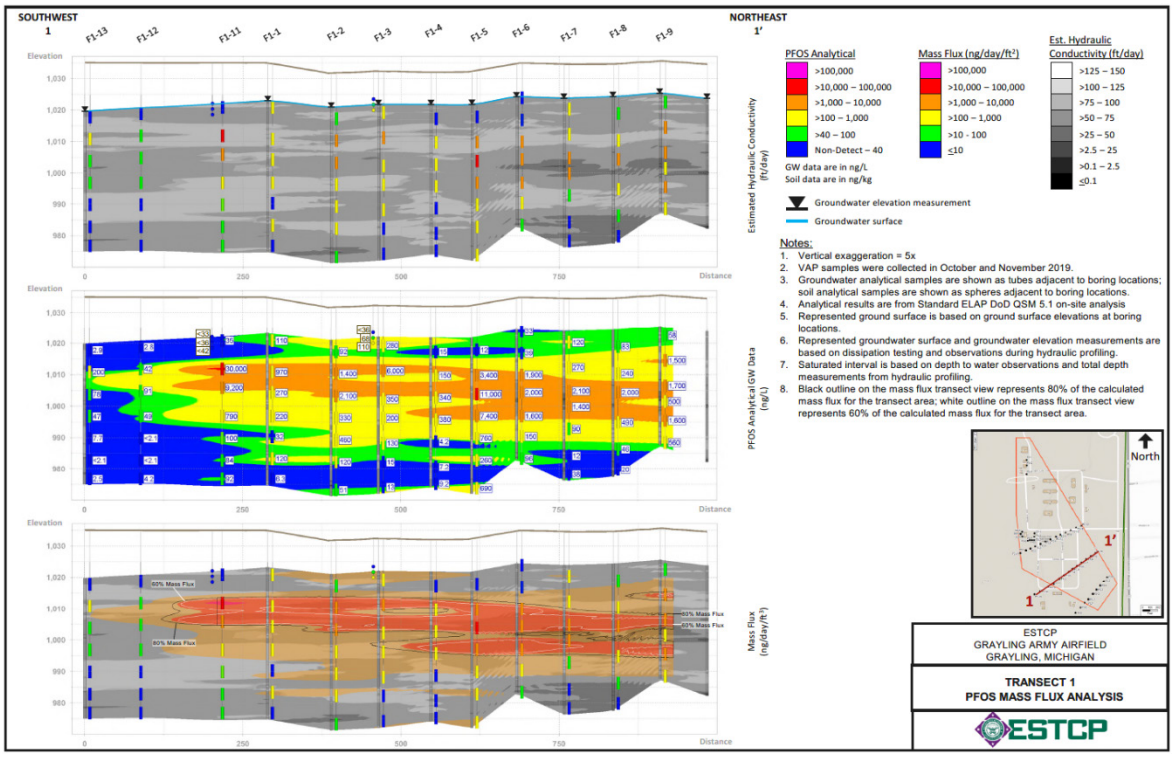



**Figure 10. Previous Estimated Hydraulic Conductivity Values and Estimated PFOS Mass Flux Transect 1 at GAAF Completed as Part of ESTCP Project ER19-5203 and Based on Data Collected in 2019.**

**Table 3. Summary of Previously Estimated PFOS and PFOA Mass Discharge Estimates as Part of ESTCP Project ER19-5203 and Based on Data Collected in 2019**

| | Hydraulic Gradient | Cross-Sectional Area | Groundwater Discharge for Cross-Sectional Area | PFOS Mass Discharge | PFOA Mass Discharge |
|---|---|---|---|---|---|
| | | square feet | gallons per minute | milligrams per day | milligrams per day |
| **Transect 2** | 0.005 | 28,312 | 52 | **122** | **6** |
| **Transect 1** | | 43,543 | 79 | **224** | **14** |
| **Transect 3** | | 25,938 | 37 | **62** | **10** |

The calculated PFOS mass discharge was greatest on Transect 1, which was also the longest transect and spans sections of both groundwater plumes (Table 3, above). The lowest PFOS mass discharge was along Transect 3, which is the farthest from the source areas, covers the smallest cross-sectional area, and does not intersect the Building 1160 plume core. Of note, although Transects 2 and 3 have similar cross-sectional areas, and Transect 2 intersected both plumes, the PFOA mass discharge was higher at Transect 1 located farther downgradient than Transect 2. The increasing concentrations of PFOA with distance may be due to the higher relative mobility of PFOA compared to PFOS. The PFOA distribution supports the conclusion of a mature plume with the highest concentrations shifted downgradient of a largely depleted source area (i.e., Building 1160). As noted above, this interpretation is also supported by the age of the source area (at least 30 years) and source sampling indicated 1 order of magnitude lower concentration of PFAS in groundwater/pore water than observed downgradient at Transects 1 and 2. For this project (ER20-5026), the VWSs was completed near Transect 2 because of its proximity to the Building 1160 source area, relatively high concentrations, and VWS length required to capture the plume core width.

# 5.0 TEST DESIGN

This section describes the baseline characterization efforts, VWS design and installation, and performance monitoring that were conducted during the demonstration to address the performance objectives described in Section 3.

## 5.1 CONCEPTUAL EXPERIMENTAL DESIGN

The overall goal of this project was to demonstrate and validate the VWS as a technology for reliable long-term monitoring of contaminant mass flux/discharge from contaminant source zones. The experimental design used to evaluate the performance objectives included six major tasks with several subtasks. The main tasks are listed below:

- Task 1: Site Selection
- Task 2: Methods Development
- Task 3: Pre-Design Data Collection
- Task 4: VWS Installations
- Task 5: Performance Monitoring
- Task 6: Reporting, Deliverables, and Technology Transition.

## 5.2 PRE-DESIGN DATA COLLECTION

At the GAAF, the prior transect-based approach (ESTCP project ER19-5203) applied the Geoprobe® HPT to assess vertical variability in K values (McCall and Christy 2020) combined with VAP groundwater sampling to assess variability in PFAS contaminant concentrations. This methodology was very successful and provided quantitative insights along the three transects investigated, showing significant variability in mass flux/discharge within the PFAS plume. Results are summarized in the Spring 2021 In Progress Report (IPR) for this project. Soil sampling was also conducted at source areas and a few locations along the transects focused on the capillary fringe and shallow water table zone to evaluate the potential PFAS mass storage within soils at the air-water interface.

The current ESTCP project (ER20-5026) was focused on one of the three existing vertical transects (Transect 2, located immediately downgradient of the source area; Figure 11) and includes the installation of two VWS installations at different depth intervals perpendicular to groundwater flow, and an additional installation forming a longsect parallel to the groundwater flow direction at a single depth interval intersecting Transect 2.

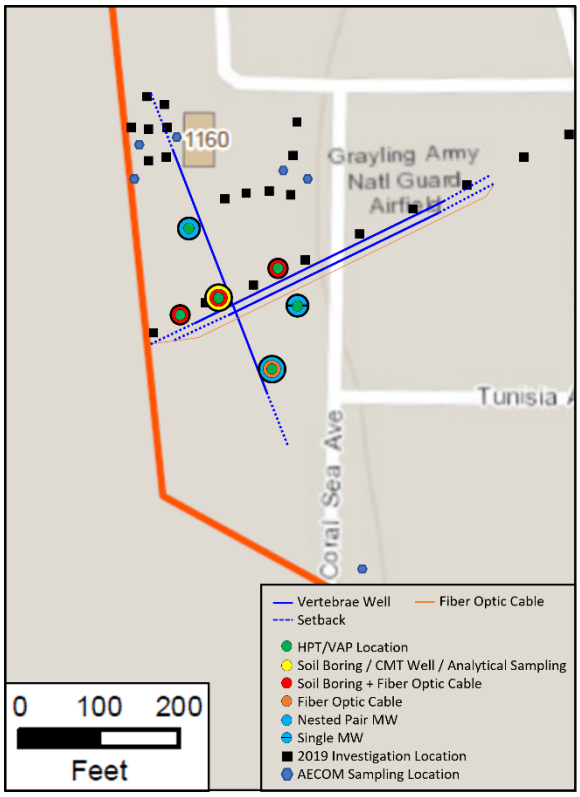



**Figure 11. Locations of the Vertebrae™ Wells and Additional Site Characterization Efforts**

The existing site characterization data were used as a basis for the locations of the VWS transects and screen sections. Furthermore, the robust mass flux/discharge estimates developed during the previous work represent a highly valuable and unique dataset that was used (and supplemented with the updated vertical transect data collected as part of this project) to evaluate mass flux/discharge values estimated with the VWS wells for the demonstration project.

Based on a detailed review of the available data and acknowledging recent advances in methodologies for site characterization with specific applicability to PFAS sites, and further considering project goals, additional vertical characterization activities were conducted. The additional site characterization efforts included additional HPT/VAP direct-push borings along the selected transect, as well as installation of conventional and multilevel wells for temporal groundwater sampling and hydraulic monitoring, which were also used for transducer deployments. The new conventional wells were positioned to provide insights on horizontal hydraulic gradients across the transect to be applied in groundwater flux/discharge estimates. Continuous cores were also collected to allow comparisons of K/groundwater flux assessed using other methods (e.g., HPT results and A-DTS) and for high-resolution sampling for PFAS concentrations at one targeted location, allowing comparison with depth-discrete groundwater sampling data conducted at a lower resolution than is possible via core sub-subsampling.

The additional characterization efforts provided insight into vertical variability, including temporal changes, and allowed improved temporal monitoring during this project period. In particular, the degree of temporal variability in the vertical dimension is of interest for application of VWSs, given these can only practically be deployed to monitor one or a few different depth zones.

Results from the additional data collection described throughout the remainder of this section were used to support the final design of the VWSs and the overall performance objectives assessment. The completed locations are shown on Figure 11, above, and the scope of work is presented in Table 4, below.

**Table 4. Summary of Pre-Design Scope of Work**

| Description | Number of Locations | Depth (feet) | Scope of Work/Data Provided |
|---|---|---|---|
| HPT borings | 6 | 40 | • Profiling of K |
| VAP borings | 5 | 40 | • Groundwater samples from five to six discrete intervals<br>• PFAS laboratory analysis<br>• Hydraulic conductivity estimates from pneumatic slug testing:<br>– Two locations with testing at four intervals<br>– One location with testing at five intervals |
| Vertical fiber optic cable | 4 | 40 DTS<br>50 total depth | • Continuous soil cores<br>• Hydraulic conductivity estimates from grain-size samples<br>• Darcy velocity from A-DTS thermal testing |
| Golden spike boring | 1 | 40 | • Continuous soil core<br>• Soil sample laboratory analysis (25 PFAS samples, five total oxidizable precursors (TOP) assay, five liquid chromatography quadrupole time of flight mass spectrometry [LC-QTOF])<br>• Hydraulic conductivity estimates from grain-size samples |
| Multilevel system (MLS) monitoring well | 1 | 40 feet (7 screens between 15 and 40 feet bgs) | • Continuous soil core (location of Golden spike boring)<br>• Groundwater samples for PFAS laboratory analysis<br>• Hydraulic head monitoring |
| Conventional monitoring wells | 5 (two clusters with two wells and one single well) | Two-well cluster: 20 feet and 30 feet<br>Single well: 20 feet | • Continuous soil cores<br>• Groundwater samples for PFAS laboratory analysis<br>• Hydraulic head monitoring (including pressure transducers in three of five wells)<br>• Hydraulic conductivity estimates from solid slug and pneumatic slug testing<br>• Darcy velocity from SWTT |

**Note:** DTS = distributed temperature sensing

### 5.2.1 Additional Hydraulic Profile Tool Borings and Vertical Aquifer Profile Sampling

Five new HPT/VAP profiles to 40 feet, with one additional HPT profile (without paired VAP) to 40 feet, were completed using the same methodologies applied in the prior investigations along the transect and longsect alignments (Figure 11, above) to provide additional vertical resolution of PFAS concentrations and mass flux/discharge for VWS placement, as well as evaluate potential temporal changes since the initial dataset was collected in 2019. Three locations filled high-value data gaps by splitting distance between previously completed HPT/VAP locations along the transect. Two locations filled high-value data gaps along the longsect (one upgradient and one downgradient of the transect).

VAP groundwater samples were collected from five to six discrete intervals per boring within a depth interval from approximately 15 to 40 feet using a Screen Point sampler with vertical sampling zones of 4 feet. Pneumatic slug tests to measure K were completed at four intervals at two HPT/VAP locations and at five intervals at one HPT/VAP location. Continuous cores were also collected at three locations. This provided additional information on lithology and soil samples for testing (e.g., grain size, thermal conductivity).

HPT borings were advanced using direct-push drilling techniques, in general accordance with procedures described in Arcadis' Technical Guidance Instruction (TGI) for Geoprobe HPT Investigations. The final data report from Cascade Technical Services, including HPT logs, is provided in Appendix B. The HPT provides a continuous profile of relative soil permeability at the centimeter scale (McCall and Christy 2020). The resulting profile was used to correlate hydrogeologic units across a site and guide selection of depth intervals for VAP groundwater sampling. The HPT tool is attached to the end of a drill string and enables a continuous metered injection of small volumes of water (typically between 200 to 300 milliliters per minute) during advancement of the probe. At the same time, the fluid backpressure due to injection into the formation, as well as the flow rate, are measured and logged at a high frequency. After correcting for atmospheric and hydrostatic pressure effects, the flow and pressure data are plotted as relative K by recognizing that K is proportional to flow divided by pressure (Q/P). The HPT also includes a dipole that logs the electrical conductivity of the soil to assist with correlating stratigraphy between HPT borings. Increasing clay content may correspond to increasing electrical conductivity. Empirical models can be applied to the datasets to provide an estimated hydraulic conductivity profile within limits at both the higher and lower end (McCall and Christy 2020). Other datasets providing K data including pneumatic slug testing and K estimated from grain size were used for comparison purposes, and potentially calibrating the estimated K from the HPT datasets.

VAP borings were advanced using direct-push drilling techniques, in general accordance with procedures described in Arcadis' TGI for VAP Sampling. VAP groundwater samples were collected from multiple discreet intervals using a 4-foot-long stainless steel screen point sampler with disposable tubing connected to a peristaltic pump. The process began by advancing a screen point sampler to the deepest interval and retracting the probe rods to expose the screen. The screened interval was developed by purging a minimum of 3 well volumes. PFAS-specific sampling considerations include avoiding PFAS-containing materials and cross-contamination potential. The groundwater samples were submitted for PFAS laboratory analysis and results are presented in Table 5. The laboratory analytical reports are provided in Appendix C.

Pneumatic slug testing was performed at select VAP groundwater sampling intervals, after the interval had been purged and sampled, to estimate K. Field testing procedures followed the Geoprobe Pneumatic Slug Test Kit Installation & Operation Instructions and Arcadis' TGI for Pneumatic Slug Testing. Pneumatic slug tests were conducted by sealing the well head and applying air pressure to depress the water level. As air pressure increased in the well, the water level fell until the water pressure and the air pressure return to equilibrium. After the water level was stable, air was released from the sealed well head by opening an air release valve. The water level recovery (i.e., rising head) typically produced very high-quality data with little interference. A pressure transducer was used to monitor and record the change of the water level in the well during the pneumatic slug test. The data were analyzed using Aqtesolv. K estimates determined by pneumatic slug testing are provided in Appendix D, along with the individual slug test solutions for each test.

Table 5
PFAS Groundwater Analytical Results - VAP Sampling
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| | Location | VAP-VRTB-01 | VAP-VRTB-01 | VAP-VRTB-01 | VAP-VRTB-01 | VAP-VRTB-01 | VAP-VRTB-01 | VAP-VRTB-01 | VAP-VRTB-02 | VAP-VRTB-02 | VAP-VRTB-02 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth Interval (ft bgs) | 34.5-38.5 | 29.5-33.5 | 25-29 | 20-24 | 15-19 | 15-19 | 15-19 | 36-40 | 36-40 | 30-34 |
| | Sample Date | 9/13/2021 | 9/13/2021 | 9/13/2021 | 9/13/2021 | 9/13/2021 | 9/13/2021 | 9/13/2021 | 9/13/2021 | 9/13/2021 | 9/14/2021 |
| **PFAS** | **Units** | | | | | | | | | | |
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | ng/L | 3.5 U | 3.6 U | 3.4 U | 3.4 U | 3.4 U | **50** | **51 J** | **56 HS** | 4.0 U | 3.5 UH | 3.4 U |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | ng/L | 3.5 U | 3.6 U | 3.4 U | 3.4 UQ | **1.8 JQ** | **28** | **41 J** | **30 H** | **2.1 J** | **2.2 HJ** | **5.2 BJ** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | ng/L | 3.5 U | 3.6 U | 3.4 U | 3.4 U | 3.4 U | 3.4 U | 70 U | 3.4 UH | 4.0 U | 3.5 UH | 3.4 U |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | ng/L | 3.5 U | 3.6 U | 3.4 U | 3.4 U | 3.4 U | 3.4 U | 70 U | 3.4 UH | 4.0 U | 3.5 UH | 3.4 U |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | ng/L | 7.0 U | 7.0 U | **6.5** | 7.0 U | 7.0 U | 7.0 U | 140 U | 7.0 UH | 8.0 U | 7.0 UH | 7.0 U |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | ng/L | 3.5 U | 3.6 U | 3.4 U | 3.4 U | 3.4 U | 3.4 U | 70 U | 3.4 UH | 4.0 U | 3.5 UH | 3.4 U |
| Perfluoro-1-butanesulfonic acid (PFBS) | ng/L | **1.1 J** | 1.8 U | **1.7 J** | **4.9** | **5.7** | **7.3** | 34 U | **7.1 H** | **1.3 J** | 1.8 UH | 1.7 U |
| Perfluoro-1-decanesulfonic acid (PFDS) | ng/L | 1.8 U | 1.8 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 34 U | 1.7 UH | 2.0 U | 1.8 UH | 1.7 U |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | ng/L | **0.93 J** | 1.8 U | **1.5 J** | **2.2 J** | **2.2 J** | **36** | **42 J** | **34 HS** | 2.0 U | 1.8 UH | 1.7 U |
| Perfluoro-1-nonanesulfonic acid (PFNS) | ng/L | 1.8 U | 1.8 U | 1.7 U | 1.7 U | 1.7 U | 1.7 US | 34 U | 1.7 UHS | 2.0 U | 1.8 UH | 1.7 U |
| Perfluoro-1-octanesulfonamide (PFOSA) | ng/L | 1.8 U | 1.8 U | 1.7 U | 1.7 U | 1.7 U | **1.8 J** | 34 U | 1.7 UH | 2.0 U | 1.8 UH | 1.7 U |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | ng/L | **1.2 J** | 1.8 U | **2.6 J** | **6.9** | **8.0** | **15** | **22 J** | **15 H** | 2.0 U | 1.8 UH | **1.0 J** |
| Perfluorohexanesulfonic acid (PFHxS) | ng/L | **17** | **16** | **44** | **76** | **77** | **550 S** | **630** | **490 HS** | **19** | **14 H** | **24** |
| Perfluoro-n-butanoic acid (PFBA) | ng/L | **2.5 J** | **2.2 J** | **5.2** | **13** | **13** | **23** | **29 J** | **22 H** | **3.9 J** | **3.6 H** | **2.1 J** |
| Perfluoro-n-decanoic acid (PFDA) | ng/L | 1.8 U | 1.8 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 34 U | 1.7 UH | 2.0 U | 1.8 UH | 1.7 U |
| Perfluoro-n-dodecanoic acid (PFDoA) | ng/L | 1.8 U | 1.8 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 34 U | 1.7 UH | 2.0 UQ | 1.8 UH | 1.7 U |
| Perfluoro-n-heptanoic acid (PFHpA) | ng/L | **1.3 J** | **1.6 J** | **6.8** | **11** | **11** | **58** | **66 J** | **60 HS** | **1.4 J** | **1.2 HJ** | **1.3 J** |
| Perfluoro-n-hexanoic acid (PFHxA) | ng/L | **2.8 J** | **2.5 J** | **9.5** | **17** | **16** | **64** | **68** | **60 HS** | **4.0** | **2.9 HJ** | **2.3 J** |
| Perfluoro-n-nonanoic acid (PFNA) | ng/L | 1.8 U | 1.8 U | **1.1 J** | **0.99 J** | **1.1 J** | **42** | **49 J** | **46 H** | 2.0 U | 1.8 UH | **0.88 J** |
| Perfluoro-n-octanoic acid (PFOA) | ng/L | **2.4 J** | **2.3 J** | **11** | **15** | **15** | **95 S** | **110** | **91 H** | **2.9 J** | **2.5 HJ** | **1.9 J** |
| Perfluoro-n-pentanoic acid (PFPeA) | ng/L | **1.9 J** | **2.1 J** | **10** | **18** | **17** | **42** | **49 J** | **42 H** | **2.1 J** | **1.5 HJ** | **1.6 J** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | ng/L | 1.8 U | 1.8 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 34 U | 1.7 UH | 2.0 UQ | 1.8 UH | 1.7 U |
| Perfluoro-n-tridecanoic acid (PFTrDA) | ng/L | 1.8 U | 1.8 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 34 U | 1.7 UH | 2.0 UQ | 1.8 UH | 1.7 U |
| Perfluoro-n-undecanoic acid (PFUdA) | ng/L | 1.8 U | 1.8 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 34 U | 1.7 UH | 2.0 U | 1.8 UH | 1.7 U |
| Perfluorooctanesulfonic acid (PFOS) | ng/L | **150** | **37** | **58** | **94** | **95** | **7100 ES** | **7300** | **6900 BHES** | **100** | **73 BH** | **78** |

**Notes:**

1**. Bold -** Result denotes detection

**Abbreviations:**

ft bgs - feet below ground surface
ID - Identification
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
TOP - total oxidizable precursor

**Qualifiers:**

B - Detected in the method blank
E - Quantitation of compound exceeded the calibration range
H - Out of holding time

J - Estimated value between the limit of quantitation and the method detection limit.

Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)

S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 5
PFAS Groundwater Analytical Results - VAP Sampling
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VAP-VRTB-02 | VAP-VRTB-02 | VAP-VRTB-02 | VAP-VRTB-02 | VAP-VRTB-02 | VAP-VRTB-02 | VAP-VRTB-03 | VAP-VRTB-03 | VAP-VRTB-03 | VAP-VRTB-03 | VAP-VRTB-03 | VAP-VRTB-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | 30-34 | 25-29 | 25-29 | 20-24 | 15-19 | 15-19 | 36-40 | 32-36 | 27.5-31.5 | 23-27 | 19-23 | 15-19 |
| Sample Date | | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/16/2021 | 9/16/2021 | 9/16/2021 | 9/16/2021 | 9/16/2021 | 9/16/2021 |
| **PFAS** | **Units** | | | | | | | | | | | | |
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | ng/L | 3.4 UH | 3.5 U | 3.4 UH | 4.0 U | **3.8 JQ** | **2.9 J** | 3.4 U | 3.5 U | 3.5 U | 33 U | 340 U | **2.1 J** |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | ng/L | 3.4 UH | **4.9 BJ** | **2.7 BHJ** | 4.0 U | **2.5 BJ** | 3.5 UQ | 3.4 U | 3.5 UQ | 3.5 UQ | 33 U | 340 U | **2.4 J** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | ng/L | 3.4 UH | 3.5 U | 3.4 UH | 4.0 U | 4.6 U | 3.5 U | 3.4 U | 3.5 U | 3.5 U | 33 U | 340 U | 3.5 U |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | ng/L | 3.4 UH | 3.5 U | 3.4 UH | 4.0 UQ | 4.6 UQ | 3.5 U | 3.4 U | 3.5 U | 3.5 U | 33 U | 340 U | 3.5 U |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | ng/L | 6.5 UH | 7.0 U | 6.5 UH | 8.0 UQ | 9.0 UQ | **7.0** | 7.0 U | 7.0 U | 7.0 U | 65 U | 700 U | 7.0 U |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | ng/L | 3.4 UH | 3.5 U | 3.4 UH | 4.0 UQ | 4.6 UQ | 3.5 U | 3.4 U | 3.5 U | 3.5 U | 33 U | 340 U | 3.5 U |
| Perfluoro-1-butanesulfonic acid (PFBS) | ng/L | 1.7 UH | **1.3 J** | **1.3 HJ** | **1.6 J** | **2.3 J** | **1.7 J** | 1.7 U | **6.6** | 1.7 U | 17 U | 170 U | **73** |
| Perfluoro-1-decanesulfonic acid (PFDS) | ng/L | 1.7 UH | 1.7 U | 1.7 UH | 2.0 U | 2.3 U | 1.8 U | 1.7 U | 1.8 U | 1.7 U | 17 U | 170 U | 1.7 U |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | ng/L | 1.7 UH | **1.1 J** | **1.0 HJ** | **2.6 J** | **3.3 J** | **2.3 J** | 1.7 U | **2.1 J** | 1.7 U | 17 U | 170 U | **4.9** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | ng/L | 1.7 UH | 1.7 U | 1.7 UH | 2.0 U | 2.3 U | 1.8 U | 1.7 U | 1.8 U | 1.7 U | 17 U | 170 U | 1.7 U |
| Perfluoro-1-octanesulfonamide (PFOSA) | ng/L | 1.7 UH | 1.7 U | 1.7 UH | 2.0 U | 2.3 U | 1.8 U | 1.7 U | 1.8 U | 1.7 U | 17 U | 170 U | 1.7 U |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | ng/L | **0.85 HJ** | **1.0 J** | **1.0 HJ** | **2.0 J** | **1.9** | **1.6 J** | **3.5** | **8.3** | 1.7 U | **10 J** | 170 U | **3.5** |
| Perfluorohexanesulfonic acid (PFHxS) | ng/L | **21 H** | **31** | **31 H** | **59** | **72** | **54** | **39** | **110** | 1.7 U | **160** | **1400** | **90** |
| Perfluoro-n-butanoic acid (PFBA) | ng/L | **1.9 HJ** | **3.6** | **3.2 HJ** | **6.8** | **7.5** | **5.3** | **2.4 J** | **7.0** | 1.7 U | **19 J** | 170 U | **21** |
| Perfluoro-n-decanoic acid (PFDA) | ng/L | 1.7 UH | 1.7 U | 1.7 UH | 2.0 U | 2.3 U | 1.8 U | 1.7 U | 1.8 U | 1.7 U | 17 U | 170 U | 1.7 U |
| Perfluoro-n-dodecanoic acid (PFDoA) | ng/L | 1.7 UH | 1.7 U | 1.7 UH | 2.0 UQ | 2.3 UQ | 1.8 U | 1.7 U | 1.8 U | 1.7 U | 17 U | 170 U | 1.7 U |
| Perfluoro-n-heptanoic acid (PFHpA) | ng/L | **1.2 HJ** | **3.6** | **3.3 H** | **7.4** | **12** | **8.8** | **1.1 J** | **5.2** | 1.7 U | **18 J** | **91 J** | **59** |
| Perfluoro-n-hexanoic acid (PFHxA) | ng/L | **2.0 HJ** | **2.8 J** | **2.5 HJ** | **7.6** | **10** | **7.5** | **4.1** | **11** | 1.7 U | **31 J** | **190 J** | **40** |
| Perfluoro-n-nonanoic acid (PFNA) | ng/L | **0.88 HJ** | **1.2 J** | **1.2 HJ** | **1.2 J** | **2.5 J** | **2.2 J** | 1.7 U | 1.8 U | 1.7 U | 17 U | 170 U | **7.2** |
| Perfluoro-n-octanoic acid (PFOA) | ng/L | **1.7 HJ** | **4.2** | **4.4 H** | **10** | **9.4** | **6.7** | **2.1 J** | **8.5** | 1.7 U | **24 J** | **160 J** | **53** |
| Perfluoro-n-pentanoic acid (PFPeA) | ng/L | **1.3 HJ** | **2.4 J** | **2.3 HJ** | **6.3** | **9.2** | **6.8** | **2.1 J** | **7.2** | 1.7 U | **29 J** | **100 J** | **47** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | ng/L | 1.7 UH | 1.7 U | 1.7 UH | 2.0 UQ | 2.3 UQ | 1.8 U | 1.7 U | 1.8 U | 1.7 UQ | 17 U | 170 U | 1.7 U |
| Perfluoro-n-tridecanoic acid (PFTrDA) | ng/L | 1.7 UH | 1.7 U | 1.7 UH | 2.0 UQ | 2.3 UQ | 1.8 U | 1.7 U | 1.8 U | 1.7 U | 17 U | 170 U | 1.7 U |
| Perfluoro-n-undecanoic acid (PFUdA) | ng/L | 1.7 UH | 1.7 U | 1.7 UH | 2.0 UQ | 2.3 UQ | 1.8 U | 1.7 U | 1.8 U | 1.7 U | 17 U | 170 U | 1.7 U |
| Perfluorooctanesulfonic acid (PFOS) | ng/L | **71 H** | **92** | **90 H** | **85** | **650** | **500** | **16** | **52** | 1.7 U | **1200** | **18000** | **760 B** |

**Notes:**

1**. Bold -** Result denotes detection

**Abbreviations:**

ft bgs - feet below ground surface
ID - Identification
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
TOP - total oxidizable precursor

**Qualifiers:**

B - Detected in the method blank
E - Quantitation of compound exceeded the calibration range
H - Out of holding time
J - Estimated value between the limit of quantitation and the method detection limit.
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 5
PFAS Groundwater Analytical Results - VAP Sampling
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VAP-VRTB-04 | VAP-VRTB-04 | VAP-VRTB-04 | VAP-VRTB-04 | VAP-VRTB-04 | VAP-VRTB-05 | VAP-VRTB-05 | VAP-VRTB-05 | VAP-VRTB-05 | VAP-VRTB-05 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | 36-40 | 29-33 | 23.5-27.5 | 19.5-23.5 | 15.5-19.5 | 36-40 | 31-35 | 26-30 | 21.5-25.5 | 16.5-20.5 |
| Sample Date | | 9/13/2021 | 9/13/2021 | 9/13/2021 | 9/13/2021 | 9/13/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 |
| **PFAS** | **Units** | | | | | | | | | | |
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | ng/L | 3.4 UQ | 3.4 U | 3.4 U | **1.9 J** | 3.4 U | 3.4 U | 3.5 U | 3.4 U | **3.2 J** | **100** |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | ng/L | 3.4 UQ | 3.4 UG | 17 U | **2.2 BJ** | **3.4** | **1.8 J** | 3.5 U | 3.4 U | **2.5 J** | **140** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | ng/L | 3.4 U | 3.4 U | 3.4 U | 3.4 U | 3.4 UQ | 3.4 U | 3.5 U | 3.4 U | 4.1 U | 3.5 U |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | ng/L | 3.4 U | 3.4 U | 3.4 U | 3.4 U | 3.4 U | 3.4 U | 3.5 U | 3.4 U | 4.1 U | 3.5 U |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | ng/L | 7.0 U | 7.0 U | 6.5 U | 7.0 U | 7.0 U | 7.0 U | 7.0 U | 7.0 U | 8.0 U | 7.0 U |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | ng/L | 3.4 U | 3.4 U | 3.4 U | 3.4 U | 3.4 U | 3.4 U | 3.5 U | 3.4 U | 4.1 U | 3.5 U |
| Perfluoro-1-butanesulfonic acid (PFBS) | ng/L | **10** | **7.4** | **3.5** | **11** | **3.6** | **8.9** | **15** | **11** | **12** | **7.6** |
| Perfluoro-1-decanesulfonic acid (PFDS) | ng/L | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.8 U | 1.7 U | 2.0 U | 1.8 UQ |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | ng/L | **3.9** | **2.4 J** | **16** | **78 S** | **9.5** | **25** | **22** | **17** | **16** | **81** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | ng/L | **1.7** | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.8 U | 1.7 U | 2.0 U | 1.8 UQ |
| Perfluoro-1-octanesulfonamide (PFOSA) | ng/L | **1.7** | 1.7 U | **0.95 J** | **1.3 J** | 1.7 U | 1.7 U | 1.8 U | 1.7 U | 2.0 U | 1.8 U |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | ng/L | **15** | **12** | **7.4** | **32** | **2.7 J** | **16** | **20** | **15** | **18** | **21** |
| Perfluorohexanesulfonic acid (PFHxS) | ng/L | **160** | **130** | **150** | **760** | **67** | **310** | **340** | **320** | **280** | **1000** |
| Perfluoro-n-butanoic acid (PFBA) | ng/L | **5.8** | **4.9** | **4.4** | **9.2** | **6.3** | **7.1** | **13** | **12** | **13** | **31** |
| Perfluoro-n-decanoic acid (PFDA) | ng/L | **1.7** | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.8 U | 1.7 U | 2.0 U | **0.96 J** |
| Perfluoro-n-dodecanoic acid (PFDoA) | ng/L | **1.7** | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.8 U | 1.7 U | 2.0 U | 1.8 U |
| Perfluoro-n-heptanoic acid (PFHpA) | ng/L | **7.7** | **5.9** | **5.0** | **14** | **11** | **8.1** | **13** | **11** | **15** | **76** |
| Perfluoro-n-hexanoic acid (PFHxA) | ng/L | **15** | **9.6** | **7.3** | **25** | **10** | **17** | **24** | **20** | **22** | **96** |
| Perfluoro-n-nonanoic acid (PFNA) | ng/L | **1.7** | 1.7 U | **3.7** | **8.4** | **2.4 J** | **1.5 J** | **1.3 J** | **1.0 J** | **3.6 J** | **78 Q** |
| Perfluoro-n-octanoic acid (PFOA) | ng/L | **21** | **16** | 15 | **55 S** | **20** | **35** | **38** | **36** | **35** | **200** |
| Perfluoro-n-pentanoic acid (PFPeA) | ng/L | **9.2** | **6.6** | **4.8** | **12** | **7.6** | **10** | **15** | **13** | **15** | **57** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | ng/L | **1.7** | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.8 U | 1.7 U | 2.0 U | 1.8 U |
| Perfluoro-n-tridecanoic acid (PFTrDA) | ng/L | **1.7** | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.8 U | 1.7 U | 2.0 U | 1.8 U |
| Perfluoro-n-undecanoic acid (PFUdA) | ng/L | **1.7** | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.8 U | 1.7 U | 2.0 U | 1.8 U |
| Perfluorooctanesulfonic acid (PFOS) | ng/L | **140** | **110** | **990** | **2500** | **230** | **470** | **340** | **260** | **740** | **18000** |

**Notes:**

1**. Bold -** Result denotes detection

**Abbreviations:**

ft bgs - feet below ground surface
ID - Identification
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
TOP - total oxidizable precursor

**Qualifiers:**

B - Detected in the method blank
E - Quantitation of compound exceeded the calibration range
H - Out of holding time
J - Estimated value between the limit of quantitation and the method detection limit.
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

### 5.2.2 Golden Spike Boring

One golden spike boring was completed using continuous core collection methodologies and a compact sonic drill rig (Boart Longyear LS-250) with a Lexan-lined split core barrel, which was advanced via sonic vibration only (no rotation) using the sonic 4 x 6 coring system with nominal 4-inch core barrel and 6-inch override casing. The core is contained within the clear Lexan liner, which is removed from the split core barrel at surface, providing less core disturbance than conventional sonic cores where the core is vibrated out of the core barrel into plastic sleeves at surface. The core barrel was over-rode with 6-inch sonic casing after each core run to maintain the borehole and for the subsequent MLS installation through the casing. At surface, the Lexan liner was placed in a cutting jig and split longitudinally using a skill saw to cut through the liner along the core axis at both sides of the core to expose the sediments, and the core was then split with scrapers for subsequent geological logging and subsample collection. Figure 12, below, shows the coring setup and process.

Soil boring logs are provided in Appendix E. This boring was installed at the location of highest expected PFAS concentrations and at the intersection of the transect and longsect VWS wells. It was also co-located with a vertical fiber optic boring and subsequent MLS installation in the same borehole. The cores were focused on an interval starting at a depth of 5 feet bgs, extending from the vadose zone across the capillary fringe and below the water table to the expected bottom of the primary plume and below the final depth of the deepest VWS to a total depth of 40 feet bgs.

The coring method selected in hindsight was not ideal for the coarser sediments at the GAAF with lack of much finer grained units, such that porewater retention, mobilization, and loss were issues that impacted the core sample results. However, alternative coring methods that would be more suitable (described below) were not available from the selected drilling contractor. Cores were collected in seven 5-foot runs over a 35-foot total vertical interval from 5 to 40 feet bgs. Figure 12, below, shows photos of the seven core runs collected and recovery is shown on Figure 13, below. Core recovery ranged from 32 to 100% (arithmetic average recovery of 67%) but with zero recovery on the first coring pass on three of the seven core runs, where core materials dropped out of the core barrel on the first pass. For these intervals the core barrel was advanced a second time through the outer (over-ride) casing to recover the lost materials, but these would have been highly disturbed. For all core runs, the core sediments were visually observed to be damp only; it is likely that much of the porewater drained from the cores during the retrieval to surface process, which would impact the subsequent core subsample results.

Alternative coring methods capable of providing greater recovery and porewater retention should be considered for any future efforts where it is desirable to use cores for detailed characterization of PFAS mass distribution. These could include consideration of the Aqualock piston sampler or cryogenic coring methods (Johnson et al. 2013; Kiaalhosseini et al. 2016; Trost et al. 2018; Kearney et al. 2024).[2]

High-resolution soil subsampling was completed at this boring (e.g., average 0.5-foot spacing, but with higher resolution targeted sampling around the capillary fringe and at low-permeability

[2] www.royaleijkelkamp.com/products/drilling-cpt/sonic-drilling/tooling/aqualock-piston-sampler/

interfaces) for PFAS porewater extraction and analyses. These employed the latest PFAS extraction methodologies including cationic PFAS extraction and analytical methods (Nickerson et al. 2020; Adamson et al. 2020) including the typical short list of approximately 24 targeted PFAS compounds, along with advanced analyses including TOP analyses and LC-QTOF analyses on selected samples. This high-resolution core sampling was intended to provide unique insights into the PFAS mass distribution, including at the capillary fringe and below the water table where not all of the mass may be mobile (e.g., sorbed mass fractions in lower permeability zones), at a resolution much higher than can be targeted with groundwater sampling. A total of 51 discrete-depth samples were collected in the field and selective analysis was employed to prioritize samples for analysis (Figure 14, below). The core samples ultimately analyzed included 27 PFAS samples, eight TOP assay samples, and five LC-QTOF samples for non-targeted PFAS analysis, plus quality assurance/quality control samples. Sample counts are discussed in Section 5.6).

Besides detailed subsampling of cores for contaminant analyses, split core samples were collected at high resolution (commensurate with observed lithologic variability) from 50 of the 51 sample depths into specimen jars. These samples were analyzed for grain-size distributions and subsequent K estimates based on grain size (Devlin 2015) for independent and comparative assessment of groundwater flux. An overview of the methods for the grain-size analyses and K estimates, along with the results, is provided in Appendix F. Continuous cores were also collected at two additional locations for paired monitoring wells with Geoprobe MC5 methods for core logging and collection of physical property samples only. The PFAS soil laboratory analytical results are presented in Tables 6 and 7.

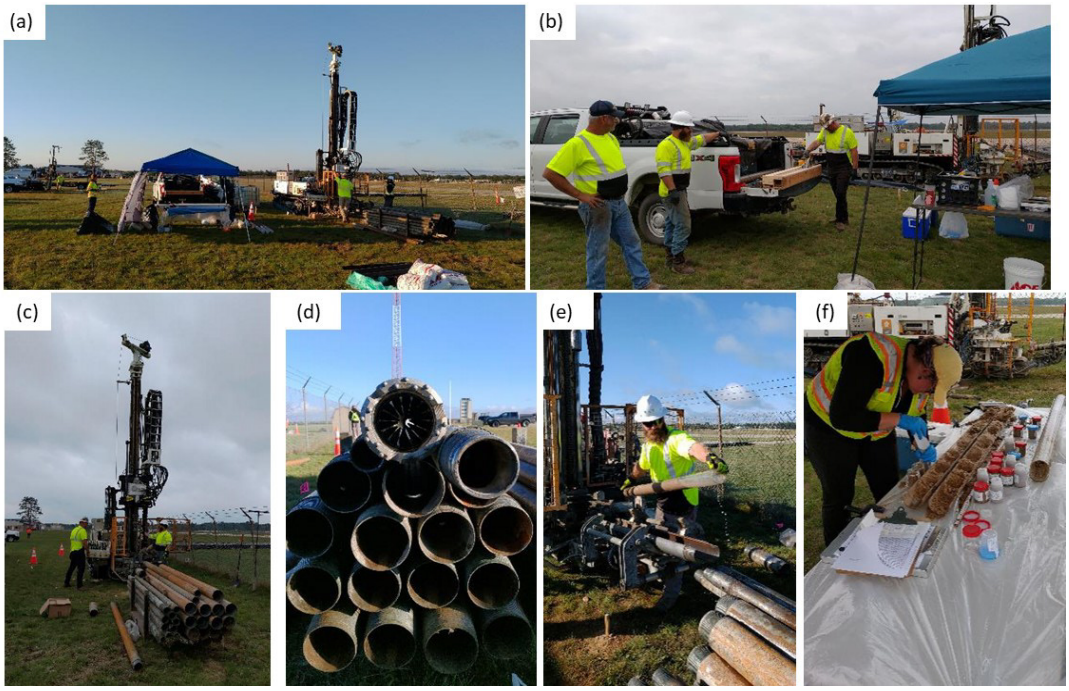



**Figure 12. Photos Taken During Golden Spike Coring Episode**

*(a) Compact sonic rig and core subsampling area, (b) Lexan liner cutting jig, (c) Compact sonic rig advancing core barrel, (d) Sonic core barrel/bit and casing, (e) Removal of Lexan liner from split core barrel, and (f) Core examination and collection of subsamples for contaminant and physical property analyses.*

Table 6
PFAS Soil Analytical Results - DOD ELAP
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | 10.5-11 | 11.5-12 | 12.5-13 | 12.5-13 | 13-13.5 | 13.75-14 | 14-14.25 | 14.25-14.5 | 14.75-15 | 15.25-15.5 | 15.75-16 |
| Sample Date | | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/15/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 |
| Analysis | | DOD ELAP | DOD ELAP | DOD ELAP | DOD ELAP | DOD ELAP | TOP Assay (pre) | DOD ELAP | DOD ELAP | TOP Assay (pre) | DOD ELAP | DOD ELAP |
| **PFAS** | **Units** | | | | | | | | | | | |
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | µg/kg | 1.0 U | 0.95 U | 0.85 U | 0.90 U | 0.90 U | 0.102 U | 0.9 U | 0.85 U | 0.097 U | 0.95 U | 0.95 U |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | µg/kg | 1.0 U | 1.0 U | 0.95 U | 0.90 U | 0.90 U | 0.204 U | 0.9 U | 0.85 U | 0.195 U | 0.95 U | 0.95 U |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | µg/kg | 1.0 U | 0.95 U | 0.85 U | 0.90 U | 0.90 U | 0.204 U | 0.9 U | 0.85 U | 0.195 U | 0.95 U | 0.95 U |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | µg/kg | 1.0 U | 0.95 U | 0.85 U | 0.90 U | 0.90 U | 0.102 U | 0.9 U | 0.85 U | 0.097 U | 0.95 U | 0.95 U |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | µg/kg | 1.0 U | 0.95 U | 0.85 U | 0.90 U | 0.90 U | MISSING | 0.9 U | 0.85 U | MISSING | 0.95 U | 0.95 U |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | µg/kg | 1.0 U | 0.95 U | 0.85 U | 0.90 U | 0.90 U | 0.051 U | 0.9 U | 0.85 U | 0.049 U | 0.95 U | 0.95 U |
| Perfluoro-1-butanesulfonic acid (PFBS) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.051 U | 0.46 U | 0.44 U | 0.049 U | 0.47 U | 0.49 U |
| Perfluoro-1-decanesulfonic acid (PFDS) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.102 U | 0.46 U | 0.44 U | 0.097 U | 0.47 U | 0.49 U |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.051 U | 0.46 U | 0.44 U | 0.049 U | 0.47 U | 0.49 U |
| Perfluoro-1-nonanesulfonic acid (PFNS) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.102 U | 0.46 U | 0.44 U | 0.097 U | 0.47 U | 0.49 U |
| Perfluoro-1-octanesulfonamide (PFOSA) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.051 U | 0.46 U | 0.44 U | 0.049 U | 0.47 U | 0.49 U |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.051 U | 0.46 U | 0.44 U | 0.049 U | 0.47 U | 0.49 U |
| Perfluorohexanesulfonic acid (PFHxS) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.102 U | 0.46 U | 0.44 U | 0.097 U | 0.47 U | 0.49 U |
| Perfluoro-n-butanoic acid (PFBA) | µg/kg | **0.22 J** | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.102 U | 0.46 U | 0.44 U | 0.097 U | 0.47 U | 0.49 U |
| Perfluoro-n-decanoic acid (PFDA) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.102 U | 0.46 U | 0.44 U | 0.097 U | 0.47 U | 0.49 U |
| Perfluoro-n-dodecanoic acid (PFDoA) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.051 U | 0.46 U | 0.44 U | 0.049 U | 0.47 U | 0.49 U |
| Perfluoro-n-heptanoic acid (PFHpA) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.051 U | 0.46 U | 0.44 U | 0.049 U | 0.47 U | 0.49 U |
| Perfluoro-n-hexanoic acid (PFHxA) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.051 U | 0.46 U | 0.44 U | 0.049 U | 0.47 U | 0.49 U |
| Perfluoro-n-nonanoic acid (PFNA) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.051 U | 0.46 U | 0.44 U | 0.049 U | 0.47 U | 0.49 U |
| Perfluoro-n-octanoic acid (PFOA) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.204 U | 0.46 U | 0.44 U | 0.195 U | **0.2 J** | 0.49 U |
| Perfluoro-n-pentanoic acid (PFPeA) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.051 U | 0.46 U | 0.44 U | 0.049 U | 0.47 U | 0.49 U |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.051 U | 0.46 U | 0.44 U | 0.049 U | 0.47 U | 0.49 U |
| Perfluoro-n-tridecanoic acid (PFTrDA) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.102 U | 0.46 U | 0.44 U | 0.097 U | 0.47 U | 0.49 U |
| Perfluoro-n-undecanoic acid (PFUdA) | µg/kg | 0.50 U | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.051 U | 0.46 U | 0.44 U | 0.049 U | 0.47 U | 0.49 U |
| Perfluorooctanesulfonic acid (PFOS) | µg/kg | **0.43 J** | 0.47 U | 0.43 U | 0.45 U | 0.44 U | 0.204 U | 0.46 U | 0.44 U | 0.195 U | **0.48 J** | **0.94 J** |

**Notes:**

1. **Bold -** Result denotes detection

**Abbreviations:**

DOD ELAP - Department of Defense Environmental Laboratory Accreditation Program
ft bgs - feet below ground surface
ID - Identification
µg/kg - micrograms per kilogram
PFAS - per- and polyfluoroalkyl substances
TOP - total oxidizable precursor

**Qualifiers:**

J = Estimated value between the limit of quantitation and the method detection limit.

S = Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U = Not detected at or above the limit of quantitation

Table 6
PFAS Soil Analytical Results - DOD ELAP
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | 16.25-16.5 | 16.5-17 | 17-17.5 | 18-18.5 | 19-19.5 | 20.5-21 | 22.5-23 | 24-24.5 | 26-26.5 | 27-27.5 | 30-30.5 | 32-32.5 |
| Sample Date | | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/14/2021 | 9/15/2021 | 9/15/2021 | 9/15/2021 |
| Analysis | | DOD ELAP | TOP Assay (pre) | DOD ELAP | DOD ELAP | TOP Assay (pre) | DOD ELAP | TOP Assay (pre) | DOD ELAP | TOP Assay (pre) | DOD ELAP | TOP Assay (pre) | DOD ELAP |
| **PFAS** | **Units** | | | | | | | | | | | | |
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | µg/kg | 1.1 U | 0.109 U | 1.1 U | 1.1 U | 0.107 U | 0.95 U | 0.111 U | 1.1 U | 0.115 U | 1.2 U | 0.110 U | 1.0 U |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | µg/kg | 1.1 U | 0.218 U | 1.1 U | 1.1 U | 0.213 U | 0.95 U | 0.222 U | 1.1 U | 0.230 U | 1.2 U | 0.221 U | 1.0 U |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | µg/kg | 1.1 U | 0.218 U | 1.1 U | 1.1 U | 0.213 U | 0.95 U | 0.222 U | 1.1 U | 0.230 U | 1.2 U | 0.221 U | 1.0 U |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | µg/kg | 1.1 U | 0.109 U | 1.1 U | 1.1 U | 0.107 U | 0.95 U | 0.111 U | 1.1 U | 0.115 U | 1.2 U | 0.110 U | 1.0 U |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | µg/kg | 1.1 U | MISSING | 1.1 U | 1.1 U | MISSING | 0.95 U | MISSING | 1.1 U | MISSING | 1.2 U | MISSING | 1.0 U |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | µg/kg | 1.1 U | 0.055 U | 1.1 U | 1.1 U | 0.053 U | 0.95 U | 0.056 U | 1.1 U | 0.058 U | 1.2 U | 0.055 U | 1.0 U |
| Perfluoro-1-butanesulfonic acid (PFBS) | µg/kg | 0.55 U | 0.055 U | 0.50 U | 0.55 U | 0.053 U | 0.47 U | 0.056 U | 0.50 U | 0.058 U | 0.55 U | 0.055 U | 0.50 U |
| Perfluoro-1-decanesulfonic acid (PFDS) | µg/kg | 0.55 U | 0.109 U | 0.50 U | 0.55 U | 0.107 U | 0.47 U | 0.111 U | 0.50 U | 0.115 U | 0.55 U | 0.110 U | 0.50 U |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | µg/kg | 0.55 U | 0.055 U | 0.50 U | 0.55 U | **0.053 J** | 0.47 U | 0.056 U | 0.50 U | 0.058 U | 0.55 U | 0.055 U | 0.50 U |
| Perfluoro-1-nonanesulfonic acid (PFNS) | µg/kg | 0.55 U | 0.109 U | 0.50 U | 0.55 U | 0.107 U | 0.47 U | 0.111 U | 0.50 U | 0.115U | 0.55 U | 0.110 U | 0.50 U |
| Perfluoro-1-octanesulfonamide (PFOSA) | µg/kg | 0.55 U | 0.055 U | 0.50 U | 0.55 U | 0.053 U | 0.47 U | 0.056 U | 0.50 U | 0.058 U | 0.55 U | 0.055 U | 0.50 U |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | µg/kg | 0.55 U | 0.055 U | 0.50 U | 0.55 U | 0.053 U | 0.47 U | 0.056 U | 0.50 U | 0.058 U | 0.55 U | 0.055 U | 0.50 U |
| Perfluorohexanesulfonic acid (PFHxS) | µg/kg | 0.55 U | **0.086 J** | **0.24 J** | **0.37** | **0.152 J** | 0.47 U | **0.062 J** | **0.28** | 0.115U | 0.55 U | 0.110 U | **0.21 J** |
| Perfluoro-n-butanoic acid (PFBA) | µg/kg | 0.55 U | 0.109 U | 0.50 U | 0.55 U | 0.107 U | 0.47 U | 0.111 U | 0.50 U | 0.115 U | 0.55 U | 0.110 U | 0.50 U |
| Perfluoro-n-decanoic acid (PFDA) | µg/kg | 0.55 U | 0.109 U | 0.50 U | 0.55 U | 0.107 U | 0.47 U | 0.111 U | 0.50 U | 0.115 U | 0.55 U | 0.110 U | 0.50 U |
| Perfluoro-n-dodecanoic acid (PFDoA) | µg/kg | 0.55 U | 0.055 U | 0.50 U | 0.55 U | 0.053 U | 0.47 U | 0.056 U | 0.50 U | 0.058 U | 0.55 U | 0.055 U | 0.50 U |
| Perfluoro-n-heptanoic acid (PFHpA) | µg/kg | 0.55 U | 0.055 U | 0.50 U | 0.55 U | 0.053 U | 0.47 U | 0.056 U | 0.50 U | 0.058 U | 0.55 U | 0.055 U | 0.50 U |
| Perfluoro-n-hexanoic acid (PFHxA) | µg/kg | 0.55 U | 0.055 U | 0.50 U | 0.55 U | **0.024 J** | 0.47 U | 0.056 U | 0.50 U | 0.058U | 0.55 U | 0.055 U | 0.50 U |
| Perfluoro-n-nonanoic acid (PFNA) | µg/kg | 0.55 U | 0.055 U | 0.50 U | 0.55 U | 0.053 U | 0.47 U | 0.056 U | 0.50 U | 0.058 U | 0.55 U | 0.055 U | 0.50 U |
| Perfluoro-n-octanoic acid (PFOA) | µg/kg | 0.55 U | 0.218 U | 0.50 U | 0.55 U | 0.213 U | 0.47 U | 0.222 U | 0.50 U | 0.230 U | 0.55 U | 0.221U | 0.50 U |
| Perfluoro-n-pentanoic acid (PFPeA) | µg/kg | 0.55 U | 0.055 U | 0.50 U | 0.55 U | 0.053 U | 0.47 U | 0.056 U | 0.50 U | 0.058 U | 0.55 U | 0.055 U | 0.50 U |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | µg/kg | 0.55 U | 0.055 U | 0.50 U | 0.55 U | 0.053 U | 0.47 U | 0.056 U | 0.50 U | 0.058 U | 0.55 U | 0.055 U | 0.50 U |
| Perfluoro-n-tridecanoic acid (PFTrDA) | µg/kg | 0.55 U | 0.109 U | 0.50 U | 0.55 U | 0.107 U | 0.47 U | 0.111U | 0.50 U | 0.115 U | 0.55 U | 0.110 U | 0.50 U |
| Perfluoro-n-undecanoic acid (PFUdA) | µg/kg | 0.55 U | 0.055 U | 0.50 U | 0.55 U | 0.053 U | 0.47 U | 0.056 U | **0.50** | 0.058 U | 0.55 U | 0.055 U | 0.50 U |
| Perfluorooctanesulfonic acid (PFOS) | µg/kg | **3.1** | **1.35** | **7.1** | **41** | **5.62** | **1.4** | **3.78** | **10** | **0.171 J** | 0.55 U | **0.387 J** | **5.8 S** |

**Notes:**

1. **Bold -** Result denotes detection

**Abbreviations:**

DOD ELAP - Department of Defense Environmental Laboratory Accreditation Program
ft bgs - feet below ground surface
ID - Identification
µg/kg - micrograms per kilogram
PFAS - per- and polyfluoroalkyl substances
TOP - total oxidizable precursor

**Qualifiers:**

J = Estimated value between the limit of quantitation and the method detection limit.

S = Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U = Not detected at or above the limit of quantitation

**Table 6**
**PFAS Soil Analytical Results - DOD ELAP**
**ESTCP Final Report**
**Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge**
**Grayling, Michigan**

| Location | | SB-VRTB-03 | SB-VRTB-03 | SB-VRTB-03 |
|---|---|---|---|---|
| Depth Interval (ft bgs) | | 34-34.5 | 34-34.5 | 35-35.5 |
| Sample Date | | 9/15/2021 | 9/15/2021 | 9/15/2021 |
| Analysis | | DOD ELAP | DOD ELAP | DOD ELAP |
| **PFAS** | **Units** | | | |
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | µg/kg | 1.1 U | 1.1 U | 1.0 U |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | µg/kg | 1.1 U | 1.1 U | 1.0 U |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | µg/kg | 1.1 U | 1.1 U | 1.0 U |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | µg/kg | 1.1 U | 1.1 U | 1.0 U |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | µg/kg | 1.1 U | 1.1 U | 1.0 U |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | µg/kg | 1.1 U | 1.1 U | 1.0 U |
| Perfluoro-1-butanesulfonic acid (PFBS) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-1-decanesulfonic acid (PFDS) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-1-nonanesulfonic acid (PFNS) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-1-octanesulfonamide (PFOSA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluorohexanesulfonic acid (PFHxS) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-n-butanoic acid (PFBA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-n-decanoic acid (PFDA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-n-dodecanoic acid (PFDoA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-n-heptanoic acid (PFHpA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-n-hexanoic acid (PFHxA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-n-nonanoic acid (PFNA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-n-octanoic acid (PFOA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-n-pentanoic acid (PFPeA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-n-tridecanoic acid (PFTrDA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluoro-n-undecanoic acid (PFUdA) | µg/kg | 0.55 U | 0.50 U | 0.50 U |
| Perfluorooctanesulfonic acid (PFOS) | µg/kg | 0.55 U | 0.50 U | 0.50 U |

**Notes:**

1. **Bold -** Result denotes detection

**Abbreviations:**

DOD ELAP - Department of Defense Environmental Laboratory Accreditation Program
ft bgs - feet below ground surface
ID - Identification
µg/kg - micrograms per kilogram
PFAS - per- and polyfluoroalkyl substances
TOP - total oxidizable precursor

**Qualifiers:**

J = Estimated value between the limit of quantitation and the method detection limit.

S = Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U = Not detected at or above the limit of quantitation

Table 7
PFAS Soil Analytical Results - Top Assay
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | SB-VRTB-03 | | SB-VRTB-03 | | SB-VRTB-03 | | SB-VRTB-03 | | SB-VRTB-03 | | SB-VRTB-03 | | SB-VRTB-03 | | SB-VRTB-03 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | 13.75-14 | | 14.75-15 | | 16.5-17 | | 19-19.5 | | 22.5-23 | | 26-26.5 | | 30-30.5 | | 36-36.5 | |
| Sample Date | | 9/14/2021 | | 9/14/2021 | | 9/14/2021 | | 9/14/2021 | | 9/14/2021 | | 9/14/2021 | | 9/15/2021 | | 9/15/2021 | |
| Analysis | Units | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| **PFAS** | | | | | | | | | | | | | | | | | |
| 11Cl-PF3OUdS | µg/kg | 0.051 U | 0.051 U | 0.049 U | 0.051 U | 0.055 U | 0.055 U | 0.053 U | 0.052 U | 0.056 U | 0.055 U | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | µg/kg | 0.204 U | 0.205 U | 0.195 U | 0.203 U | 0.218 U | 0.218 U | 0.213 U | 0.208 U | 0.222 U | 0.221 U | 0.230 U | 0.230 U | 0.221 U | 0.221 U | 0.225 U | 0.227 U |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | µg/kg | 0.204 U | 0.205 U | 0.195 U | 0.203 U | 0.218 U | 0.218 U | 0.213 U | 0.208 U | 0.222 U | 0.221 U | 0.230 U | 0.230 U | 0.221 U | 0.221 U | 0.225 U | 0.227 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | µg/kg | 0.102 U | 0.102 U | 0.097 U | 0.102 U | 0.109 U | 0.109 U | 0.107 U | 0.104 U | 0.111 U | 0.110 U | 0.115 U | 0.115 U | 0.110 U | 0.110 U | 0.112 U | 0.113 U |
| 9Cl-PF3ONS | µg/kg | 0.102 U | 0.102 U | 0.097 U | 0.102 U | 0.109 U | 0.109 U | 0.107 U | 0.104 U | 0.111 U | 0.110 U | 0.115 U | 0.115 U | 0.110 U | 0.110 U | 0.112 U | 0.113 U |
| ADONA | µg/kg | 0.051 U | 0.051 U | 0.049 U | 0.051 U | 0.055 U | 0.055 U | 0.053 U | 0.052 U | 0.056 U | 0.055 U | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |
| NEtFOSAA | µg/kg | 0.102 U | 0.102 U | 0.097 U | 0.102 U | 0.109 U | 0.109 U | 0.107 U | 0.104 U | 0.111 U | 0.110 U | 0.115 U | 0.115 U | 0.110 U | 0.110 U | 0.112 U | 0.113 U |
| NMeFOSAA | µg/kg | 0.051 U | 0.051 U | 0.049 U | 0.051 U | 0.055 U | 0.055 U | 0.053 U | 0.052 U | 0.056 U | 0.055 U | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | µg/kg | 0.511 U | 0.512 U | 0.487 U | 0.508 U | 0.545 U | 0.546 U | 0.533 U | 0.521 U | 0.056 U | 0.552 U | 0.576 U | 0.057 U | 0.055 U | 0.055 U | 0.562 U | 0.567 U |
| Perfluorobutanesulfonic acid (PFBS) | µg/kg | 0.051 U | 0.051 U | 0.049 U | 0.051 U | 0.055 U | 0.055 U | 0.053 U | 0.052 U | 0.056 U | 0.055 U | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |
| Perfluorobutanoic acid (PFBA) | µg/kg | 0.102 U | 0.102 U | 0.097 U | **0.296 J** | 0.109 U | **0.046 J** | 0.107 U | **0.047 J** | 0.111 U | **0.055 J** | 0.115 U | 0.115 U | 0.110 U | 0.110 U | 0.112 U | 0.113 U |
| Perfluorodecane sulfonic acid (PFDS) | µg/kg | 0.102 U | 0.102 U | 0.097 U | 0.102 U | 0.109 U | 0.109 U | 0.107 U | 0.104 U | 0.111 U | 0.110 U | 0.115 U | 0.115 U | 0.110 U | 0.110 U | 0.112 U | 0.113 U |
| Perfluorodecanoic acid (PFDA) | µg/kg | 0.102 U | 0.102 U | 0.097 U | 0.102 U | 0.109 U | 0.109 U | 0.107 U | 0.104 U | 0.111 U | 0.110 U | 0.115 U | 0.115 U | 0.110 U | 0.110 U | 0.112 U | 0.113 U |
| Perfluorododecanoic acid (PFDoA) | µg/kg | 0.051 U | 0.512 U | 0.049 U | 0.051 U | 0.055 U | 0.055 U | 0.053 U | 0.052 U | 0.056 U | 0.055 U | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |
| Perfluoroheptanesulfonic acid (PFHpS) | µg/kg | 0.051 U | 0.512 U | 0.049 U | 0.051 U | 0.055 U | 0.055 U | **0.053 J** | **0.023 J** | 0.056 U | **0.038 J** | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |
| Perfluoroheptanoic acid (PFHpA) | µg/kg | 0.051 U | 0.512 U | 0.049 U | **0.090 J** | 0.055 U | **0.024 J** | 0.053 U | **0.037 J** | 0.056 U | **0.038 J** | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |
| Perfluorohexanesulfonic acid (PFHxS) | µg/kg | 0.102 U | 0.102 U | 0.097 U | **0.035 J** | **0.086 J** | **0.174 J** | **0.152 J** | **0.161 J** | **0.062 J** | **0.196 J** | 0.115U | 0.115 U | 0.110 U | **0.043 J** | 0.112 U | 0.113 U |
| Perfluorohexanoic acid (PFHxA) | µg/kg | 0.051 U | **0.021 J** | 0.049 U | **0.193 J** | 0.055 U | **0.225 J** | **0.024 J** | **0.302 J** | 0.056 U | **0.290 J** | 0.058U | 0.057 U | 0.055 U | **0.035 J** | 0.056 U | 0.057 U |
| Perfluorononanesulfonic acid (PFNS) | µg/kg | 0.102 U | 0.102U | 0.097 U | 0.102 U | 0.109 U | 0.109 U | 0.107 U | 0.104 U | 0.111 U | 0.110 U | 0.115U | 0.115 U | 0.110 U | 0.110 U | 0.112 U | 0.113 U |
| Perfluorononanoic acid (PFNA) | µg/kg | 0.051 U | 0.051 U | 0.049 U | 0.051 U | 0.055 U | 0.055 U | 0.053 U | 0.052 U | 0.056 U | 0.055 U | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |
| Perfluorooctane Sulfonamide (FOSA) | µg/kg | 0.051 U | 0.051 U | 0.049 U | 0.051 U | 0.055 U | 0.055 U | 0.053 U | 0.052 U | 0.056 U | 0.055 U | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |
| Perfluorooctanesulfonic acid (PFOS) | µg/kg | 0.204 U | 0.205 U | 0.195 U | 0.203 U | **1.35** | **2.37** | **5.62** | **5.07** | **3.78** | **10.3** | **0.171 J** | **0.062 J** | **0.387 J** | **0.641 J** | 0.225 U | 0.227 U |
| Perfluorooctanoic acid (PFOA) | µg/kg | 0.204 U | 0.205 U | 0.195 U | 0.203 U | 0.218 U | 0.218 U | 0.213 U | 0.208 U | 0.222 U | 0.221 U | 0.230 U | 0.230 U | 0.221U | 0.221 U | 0.225 U | 0.227 U |
| Perfluoropentanesulfonic acid (PFPeS) | µg/kg | 0.051 U | 0.051 U | 0.049 U | 0.051 U | 0.055 U | 0.055 U | 0.053 U | 0.052 U | 0.056 U | 0.055 U | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |
| Perfluoropentanoic acid (PFPeA) | µg/kg | 0.051 U | **0.030 J** | 0.049 U | **0.644 J** | 0.055 U | **0.084 J** | 0.053 U | **0.104 J** | 0.056 U | **0.114 J** | 0.058 U | 0.057 U | 0.055 U | **0.027 J** | 0.056 U | 0.057 U |
| Perfluorotetradecanoic acid (PFTA) | µg/kg | 0.051 U | 0.051 U | 0.049 U | 0.051 U | 0.055 U | 0.055 U | 0.053 U | 0.052 U | 0.056 U | 0.055 U | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |
| Perfluorotridecanoic acid (PFTrDA) | µg/kg | 0.102 U | 0.102 U | 0.097 U | 0.102 U | 0.109 U | 0.109 U | 0.107 U | 0.104 U | 0.111U | 0.110 U | 0.115 U | 0.115 U | 0.110 U | 0.110 U | 0.112 U | 0.113 U |
| Perfluoroundecanoic acid (PFUnA) | µg/kg | 0.051 U | 0.051 U | 0.049 U | 0.051 U | 0.055 U | 0.055 U | 0.053 U | 0.052 U | 0.056 U | 0.055 U | 0.058 U | 0.057 U | 0.055 U | 0.055 U | 0.056 U | 0.057 U |

**Notes:**

1. **Bold -** Result denotes detection

**Abbreviations:**

ft bgs - feet below ground surface
ID - Identification
µg/kg - micrograms per kilogram
PFAS - per- and polyfluoroalkyl substances

**Qualifiers:**
J - estimated value between the limit of quantitation and the method detection limit.
U - Not detected at or above the limit of quantitation.

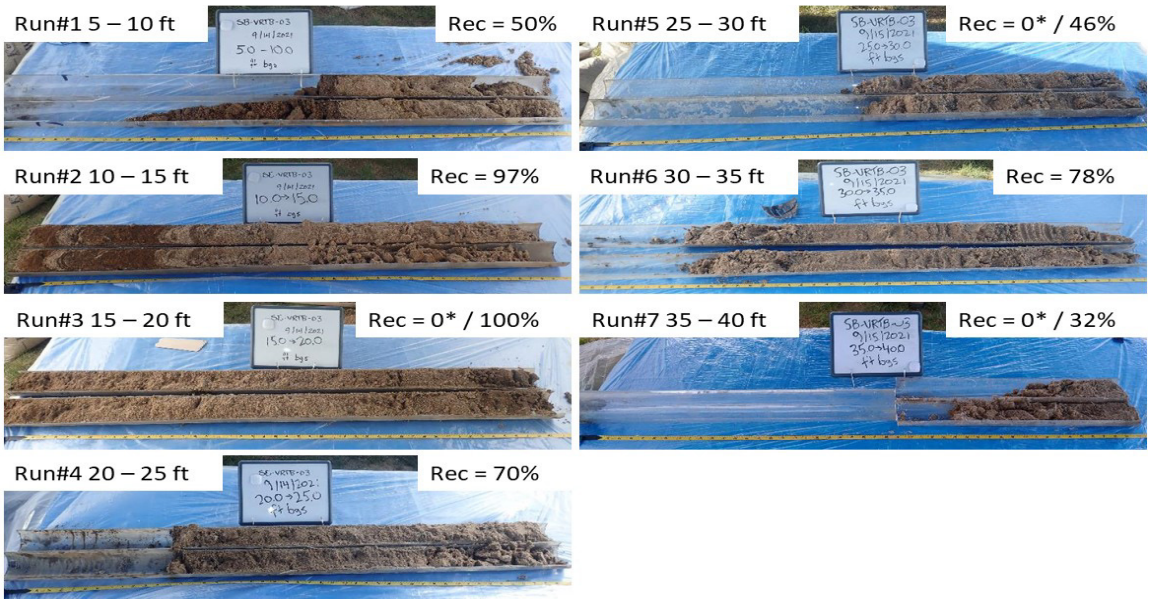



**Figure 13. Core Photos of Seven Runs (5-foot intervals) from 5 to 40 feet bgs with Recovery Percentages**

** = No recovery on first pass; materials subsequently recovered on second pass advancing core barrel through over-ride casing.*

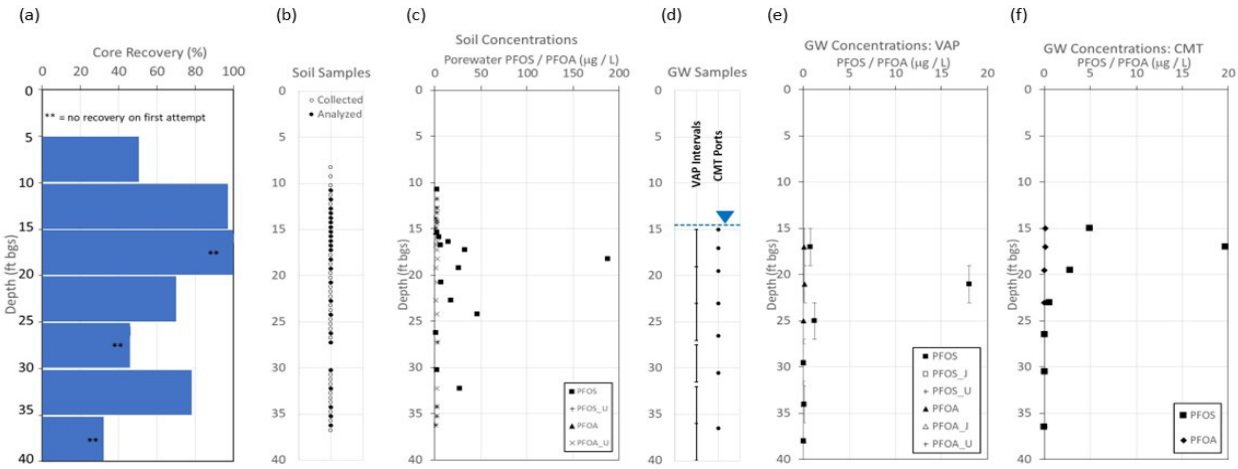



**Figure 14. Plots Showing Discrete Samples Selected for Analysis**

*(a) Core runs and recovery at the golden spike location SB-VRTB-03, (b) Distribution of soil samples (selective analyses conducted), (c) Estimated PFOS/PFOA in soil samples converted to porewater concentrations with estimated soil porosity and bulk density and assuming no sorption; solid symbols represent positive detections and open symbols nondetect (plotted at the method detection limit), (d) Groundwater sample depths from adjacent VAP sampling (blended samples) and continuous multichannel tubing (CMT) ports (discrete depth samples), (e) VAP groundwater results from 9/2021, and (f) CMT groundwater results from initial sampling episode 12/2021.*

### 5.2.3 Vertical Stand-Alone Integrated Fiber Optic and Heating Cables

The Morwick G360 Institute has developed an A-DTS method applicable to bedrock boreholes to quantify groundwater flow through fractures (Coleman et al. 2015; Maldaner et al. 2019; Munn et al. 2020). This method involves installing a composite fiber optic cable containing both optical fibers and heating wires in a borehole, temporarily sealing the borehole with a flexible liner, and heating the cable at a constant rate for an extended period (greater than 10 hours; Figure 15, below). The depth-discrete temperature is measured continuously along the full length of the borehole using a fiber optic cable (installed in the borehole) that is connected to an A-DTS at the surface. Modern DTS units can obtain high measurement, spatial, and temporal resolutions of up to +/- 0.01 degree Celsius (°C), 0.29 meter, and 2 seconds, respectively. The rate of temperature increase during heating is proportional to the bulk thermal conductivity of materials surrounding the cable at each depth. If no groundwater flow is present, this rate reflects the thermal conductivity of the saturated aquifer materials. If groundwater flow is present, the thermal conductivity is enhanced as the flow dissipates heat more efficiently, with the magnitude of the shift proportional to the groundwater flow rate (Maldaner et al. 2019). This allows depth-discrete groundwater flow rates through fractures in bedrock aquifers to be estimated using A-DTS tests.

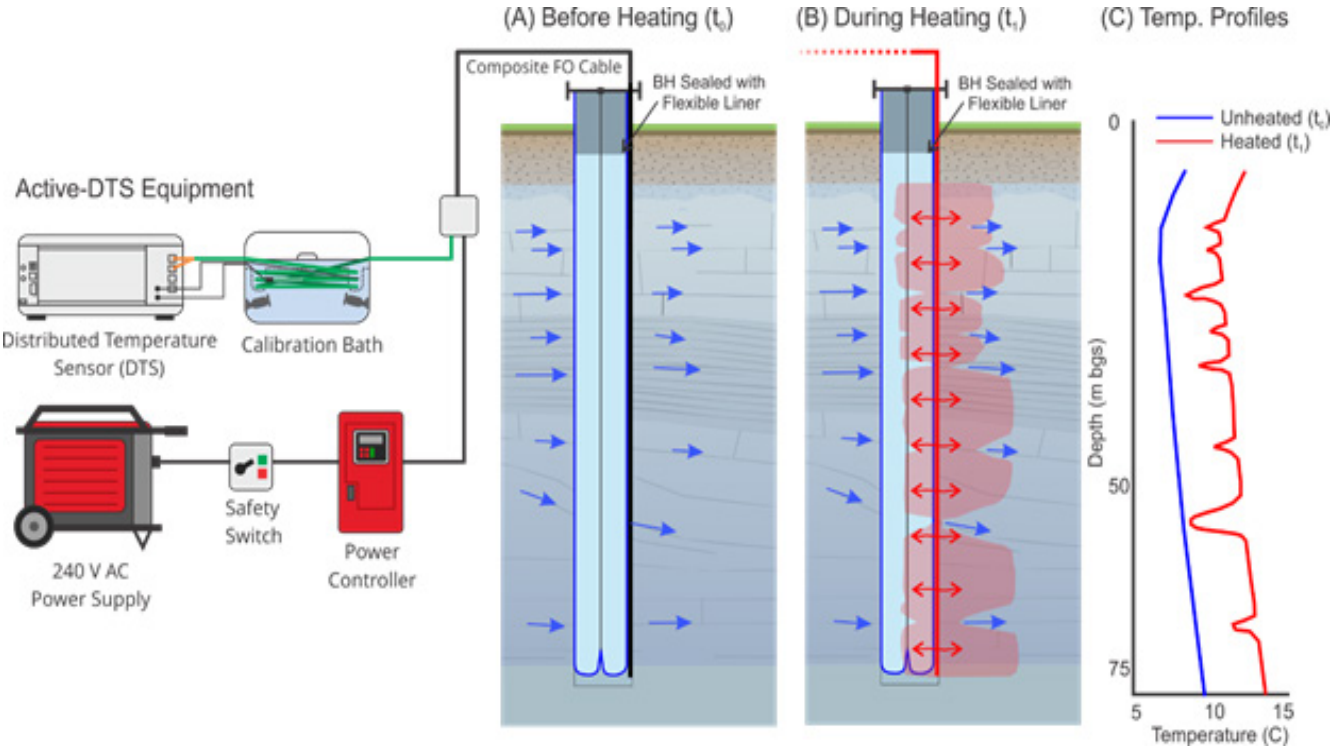



**Figure 15. Schematic of A-DTS**

*Schematic of A-DTS in a fractured rock borehole with the composite fiber optic and heating cable sealed behind a blank FLUTe™ liner. Active groundwater flow causes preferential cooling at those depths (modified from Maldaner et al. 2019).*

The University of Guelph has adapted the A-DTS methods developed for fractured bedrock and applied them to unconsolidated porous media building off experience from other researchers using DTS (Bakker et al. 2015; des Tombe et al. 2019). Initial heat and flow numerical modeling was completed to demonstrate proof of concept for unconsolidated media within the expected range of groundwater flux at GAAF. The A-DTS measurements provide another independent measurement of groundwater flux and its vertical variability, which was compared with other groundwater flux measurements from vertical characterization to identify biases in the different methods. A-DTS has also been used in unconsolidated aquifers to estimate groundwater flux. Direct-push field installations of fiber optic cables have been used in conjunction with hot water injections and active heating in sandy aquifers to quantify groundwater flux (Bakker et al. 2015; des Tombe et al. 2019). Controlled sand tank experiments have also demonstrated the ability of A-DTS tests to quantify groundwater flux using various analytical approaches (Bakx et al. 2019; Simon et al. 2020).

Installation of the composite fiber optic cable in the offset vertical deployments at the GAAF involved a similar approach to that presented by des Tombe et al. (2019), which uses custom drive-point knockout tip and assemblies that will remain in the ground once the drill rods have been removed (Figure 16, below). The knockout assembly included a stainless-steel drive point with the same dimensions as a standard Geoprobe tip, but custom machined to include a ¾-inch national pipe thread (NPT) and wrench grooves to enable attachment of a 7.5-inch (19 centimeter [cm]) extension pipe that houses the fiber optic cable termination (U-bend splice) and heating cable connection. The cable then passed through a smaller diameter protective sleeve and cable gland and was secured and sealed with epoxy. This provided a waterproof and robust cable termination that can withstand the rigors of installation.

The cables were installed in the subsurface using a Geoprobe direct-push drill rig. Once the desired depth was reached (50 feet bgs), the rods were removed, leaving the drive point and fiber optic cable in the subsurface. This sometimes required a slight tap with a metal rod inserted inside the rods to get the drive-point assembly to release form the rods. Each cable took approximately 1.5 to 2 hours to install using this approach. Once the rods were removed, the sediment was observed to collapse around the cable to approximately the water table depth, and then silica sand was added to fill the open hole above the water table to close to ground surface, and bentonite was added around the cable near surface. The collapse below the water table provides direct contact with the sediment, eliminating any thermal interference other than the cable materials. After the four cables were installed, the optical fibers and heating cables were connected at the surface using the same composite fiber optic cable to form a continuous loop. This allowed simultaneous heating and depth-discrete temperature monitoring along all four vertical installations, allowing efficient data collection. These fiber optic cable installations were at the same borehole locations as HPT/VAP and/or continuous soil core sampling. Two of the vertical fiber optic cable installations were co-located with previously completed HPT/VAP locations along the transect and one was installed at the nexus of the VWS transect and longsect. A fourth cable was installed further south along the longsect, paired with an HTP/VAP location and nested monitoring well pair.

Continuous cores were collected at all three locations along the transect (at two locations using Geoprobe MC5 methods and at the golden spike location using sonic coring methods as described above). All cores were logged in detail and subsampled for physical property analyses (e.g., grain size, permeameter tests, thermal conductivity tests). The golden spike soil cores were also subsampled for contaminant analyses as discussed above.

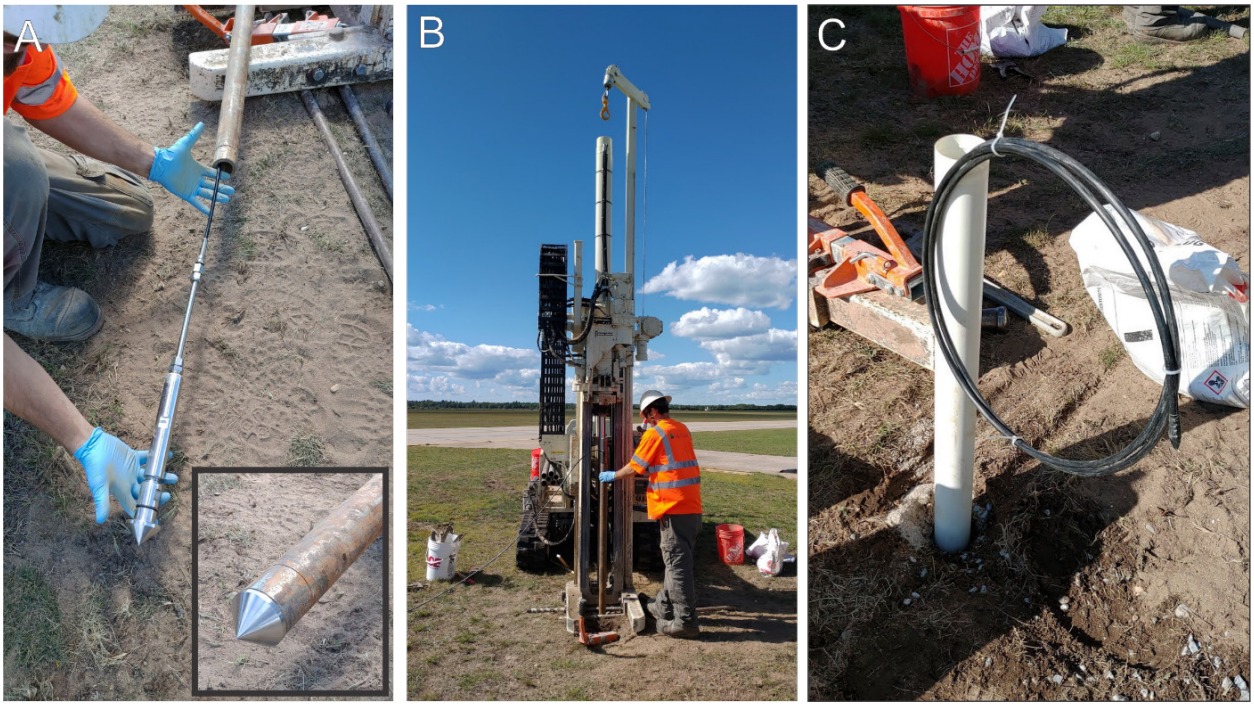



**Figure 16. Direct-Push Installation of Vertical Fiber Optic Cables for A-DTS Testing.**

*(A) Custom drive point/knockout tip with integrated U-bend housing installed into drill rods (inset showing assembly fully installed into rod), (B) Geoprobe drill rig pushing cable assembly to depth (50 feet bgs), (C) Surface cable at surface after installation with temporary PVC protective casing.*

### 5.2.4 High-Resolution Multilevel System

The installed MLS system at the golden spike location consisted of a seven-port CMT system (Einarson and Cherry 2002). Vertical screen positions were selected based on the soil boring and nearby HPT/VAP profiles, with two of the screen intervals coinciding with similar depths as the VWS screen intervals along the transect. The seven CMT ports were positioned within a depth range of 15.0 to 36.5 feet bgs, with vertical distance between ports ranging from 2.0 feet in the shallow interval near the water table to a maximum spacing between ports of 6.0 feet at depth. The system was constructed in the field following the CMT instruction manual by personnel experienced with construction of these systems.[3]

Figure 17, below, shows photos of the CMT multilevel construction and installation. The CMT system was installed to the target depth of 36.5 feet through the outer 6-inch-diameter sonic override casing on the same pass as collection of the continuous cores to 40 feet deep, as described in Section 5.2.2. Following installation in the casing, the casing was retracted leaving the MLS system downhole. Because the sediments at GAAF were expected to collapse and vertical gradients were expected to be negligible, seals were not placed between the screen intervals. Soil boring logs and monitoring well construction diagrams are provided in Appendix E.

[3] www.solinst.com/products/multilevel-systems-and-remediation/403-cmt-multilevel-system/operating-instructions/

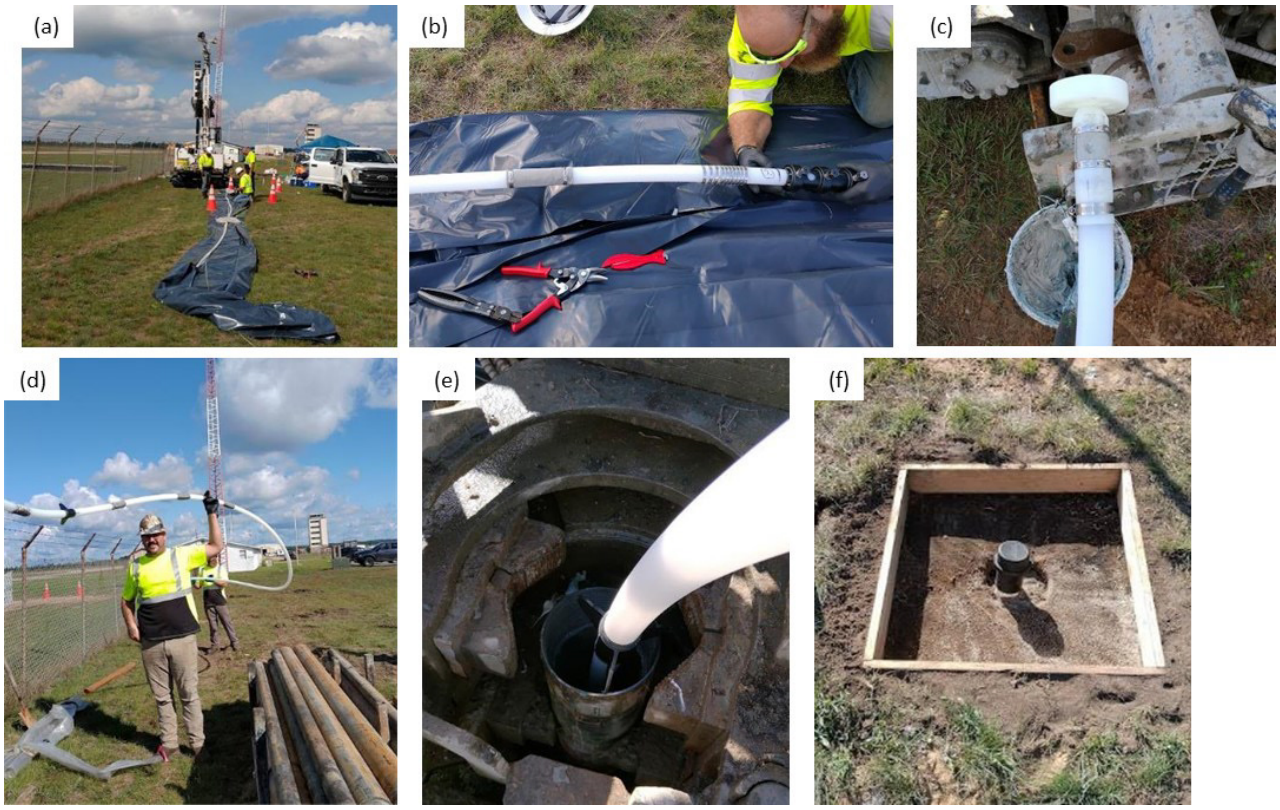



**Figure 17. Construction and Installation of Seven-Channel CMT Multilevel System**

*(a) Laying out CMT tubing on plastic sheeting to remove coil memory and marking port depths, (b) Lining up and cutting CMT ports and attaching stainless-steel screens over ports, (c) Bottommost Port 7 open to the middle channel and bottom anchor, (d) Transporting completed CMT for downhole installation, (e) Insert CMT multilevel down sonic casing, which is subsequently removed with vibration to promote collapse of sediments around the MLS, and (f) Completed CMT multilevel at surface with forms for pouring the final concrete pad.*

Following installation, the CMT ports were developed by purging using a peristaltic pump. Ports were purged until groundwater coming from each port was clear and field parameters monitored during purging efforts using a multiparameter probe verified that stabilization was achieved.

### 5.2.5 Conventional Monitoring Wells

A total of five additional monitoring wells were installed: two clustered monitoring well pairs and a single screen monitoring well. Soil boring logs and monitoring well construction diagrams are provided in Appendix E. The two new clustered (wells drilled separately, approximately 3 feet apart) monitoring well pairs were installed at different depths with short screen intervals (less than or equal to 5 feet) at two additional locations (one location upgradient and one downgradient) along the longsect coinciding with the groundwater flow direction and longsect VWS installation. One of the screens was co-located with a VWS port (i.e., spanning the same depth interval and positioned laterally at the mid-port position). The new monitoring wells were installed using HSA drilling techniques. The boreholes were continuously sampled, and the soil was described in general accordance with Arcadis' TGI for Soil Description, to depths of approximately 40 feet bgs.

After the soil cores were logged, the monitoring wells were installed in general accordance with procedures provided in Arcadis' TGI for monitoring well installation. The wells were constructed by installing 5-foot lengths of manufactured 2-inch-diameter, 10-slot (0.01-inch), rigid Schedule 40 PVC screen with a bottom cap. The actual screen intervals were determined based on conditions encountered in the field. Riser pipe consisting of 2-inch-diameter, rigid Schedule 40 PVC pipe extends from the top of the screen to ground surface and is coupled to the screen using threaded joints. The annulus around the screen was filter-packed with bagged silica sand with an appropriate grain size for the formation from the base of the borehole to approximately 2 feet above the top of the well screen. The annulus above the sandpack to the ground surface was sealed with bentonite.

Installed monitoring wells were developed to clear them of fine-grained sediment to enhance the hydraulic connection between the well and the surrounding geologic formation. Development was accomplished by evacuating well water by pumping. During well development, the pump was moved up and down the screened interval until the well yielded relatively clear water.

### 5.2.6 Pre-Design Investigation-Derived Waste Management

Investigation-derived waste (IDW) was generated during the pre-design phase of this project. Soils removed during drilling were surface spread on site; groundwater purged during well development and sampling as well as water used for decontamination purposes was also surface spread on site.

## 5.3 TREATABILITY OR LABORATORY STUDY RESULTS

Well material compatibility for sampling PFAS compounds was completed for this project by EN Rx. The laboratory study looked at several possibilities for leaching PFAS compounds and thus increasing PFAS compounds in the groundwater in addition to adsorption effects that could produce decreases in groundwater samples collected from the well screens. The two main findings are summarized below, and the summary report provided by EN Rx is provided in Appendix G:

- Only one PFAS compound (PFOA) was reported at a trace concentration (0.97 nanogram per liter [ng/L]) in a simple water rinsate sample collected from rinsing the geotextile fabric used for the construction of well screens. This concentration is below the MCL of 4.0 ng/L for PFOA. It is concluded the VWS materials will not cause leaching of PFAS compounds in applicable concentrations at most sites. However, a methanol wash procedure can be performed to ensure the VWS materials are PFAS free.
- PFAS compounds were found on the geotextile screen material and traces were found on tie wraps used to construct the VWS installed at GAAF (Table 8). Laboratory analytical results indicated the presence of 6:2-fluorotelomersulfonic acid (6:2-FTS), 4:2-fluorotelomersulfonic acid, perflouroheptanesulfonic acid, perfluorohexanoic acid, and perfluoropentanoic acid. Primarily, the main exceedance of the laboratory detection limit was centered around 6:2-FTS at 2,000 ng/g, which was several magnitudes greater than the other constituents detected (reported at trace concentrations of 3.9, 0.18, 0.33, and 0.20 ng/g, respectively), when sampling the geotextile fabric. The laboratory methods used methanol extraction to dissolve these compounds from the samples submitted. The other construction materials for the GAAF (risers and outer sleeve) did not report PFAS compounds. As a note, 6:2 FTS was also detected at 1,600 ng/g in the nylon pull tape typically used for well system construction; however, this component was removed and replaced by the tracer wire described in Section 5.4.1 for the purposes of well locating.

**Table 8. PFAS Laboratory Testing of VWS Well Materials**

| VWS Well Material Component | 6:2-FTS Initial Sampling Results | 6:2-FTS Post Pre-Cleaning Results |
|---|---|---|
| Sleeve-HDPE 3 inches | ND | ND |
| Tie-nylon wrap | 73 ng/g | ND |
| Geotextile screen wrap sock | 2,000 ng/g | ND |
| Riser-HDPE tubing ½ inch | ND | ND |
| Well screen - polyethylene proprietary design | ND | ND |

**Notes:** HDPE = high-density polyethylene
ND = nondetect

The data indicate that 6:2-FTS would not have provided any sampling interference under normal circumstances for groundwater investigation. However, all geotextile fabric used for system construction was washed using methanol and resampled to ensure no 6:2-FTS was present on the geotextile prior to installation of the VWS at the GAAF.

A minor finding of the summary report provided by EN Rx (Appendix G) was that three PFAS compounds (perflourooctanesulfonamide [PFOSA], perfluorotridecanoic acid [PFTrDA], and perfluorotetradecanoic acid [PFTeDA]), not present at the site, can adhere to the geotextile and could produce biases. However, this result was after soaking in a spike solution with very high concentrations of 1,000 ug/L for individual PFAS compounds. In addition, these are not typical primary compounds found at AFFF-impacted sites. Therefore, adhesion/adsorption biases are not practical to consider as interference when using VWS.

## 5.4 DESIGN AND LAYOUT OF TECHNOLOGY COMPONENTS

This section describes the VWS design and implementation. VWSs are premanufactured and typically no adjustments are completed in the field at the time of installation. For this reason, proper design is critical for field installation and successful well installation outcomes. This project included the installation of three VWS installations using HDD methods. Two VWSs are at different depth intervals perpendicular to groundwater flow (shallow and deep transects) and the third VWS is parallel to the groundwater flow direction at a single depth interval (longsect). In addition, a fourth boring was completed using HDD methods for installation of a stand-alone fiber optic cable for A-DTS testing. The stand-alone fiber optic cable was offset from and installed at approximately the same depth as the shallow transect VWS. As-built figures are provided in Appendix H, showing the profile and plan view layouts of the VWSs.

### 5.4.1 VWS Design Components

VWS construction is custom and can vary greatly depending on the usage. The following parameters are tailored to the specific use: riser diameter, well screen diameter, well screen slot sizes, well screen length, and spacing between well screens. Also, part of the design is the installation sleeve size (diameter), which can be adjusted to accommodate more well screens or other devices and can be altered for longer bores or more difficult lithology to accommodate higher frictions via higher tensile strength sleeves.

Typical design summary sheets with the current project design information are presented in Tables 6 and 7, below.

**Table 9. Overall VWS Design Summary**

| Well Systems | Segment (screen) Lengths | Segments | Segment Spacing (Average) |
|---|---|---|---|
| Three systems | 10 feet | Eight per system/24 total for all three systems | 35 feet |
| **Total Length (all systems)** | **Depth** | **Riser Size** | **Well Sleeve** |
| 1,390 feet | varies 20 to 30 feet | 0.75-inch HDPE | Four-inch 13.5 SDR HDPE |

**Note:** SDR = standard dimensional ratio

**Table 10. Individual VWS Summary**

| System Specs | Screen and Riser Specs | Spacing and Coverage | Other Details |
|---|---|---|---|
| Shallow transect - 500 feet with 4-inch sleeve | Eight – 10 feet long x 1-inch screens<br>Eight – 0.75-inch HDPE risers<br>Eight – 0.5-inch HDPE grout lines | 35 feet spaces for approximately 325 feet | 20 feet deep with exit<br>Full-length tracer and first well length tracer<br>One fiber optic cable full length |
| Deep transect - 501 feet with 4-inch sleeve | Eight – 10 feet long x 1-inch screens<br>Eight – 0.75-inch HDPE risers<br>Eight – 0.5-inch HDPE grout lines | 35 feet spaces for approximately 325 feet | 30 feet deep with exit |
| Longsect - 500 feet with 4-inch sleeve | Eight – 10 feet long x 1-inch screens<br>Eight – 0.75-inch HDPE risers<br>Eight – 0.5-inch HDPE grout lines | 35 feet spaces for approximately 325 feet | 20 feet deep with exit |
| Stand-alone fiber optic cable - 475 feet with two 0.75-inch sleeves (one for fiber optic cable and one for borehole development) | N/A | N/A | 20 feet deep with exit<br>1 fiber optic cable full length |

**Note:** N/A = Not applicable

The following VWS components are described further throughout the remainder of this section:

- Screens
- Risers
- A-DTS fiber optic cable
- Tracer wire
- Grout lines
- Protective sleeve.

### *5.4.1.1 VWS screens*

The first part of the design is screen selection. The VWSs generally consist of a proprietary well screen that is flexible to provide ease of installation and maximize contact with the subsurface. Typically, 1-inch nominal well screens are adequate for the flow and dimension requirements for sampling and most treatment technologies. Larger sizes are available for alternate uses. For this project, 1-inch nominal was appropriate. The well screen slot size is only changed for injection of slurries or when silts may hinder the use of the well. The application herein does not require a change from the typical geotextile sleeved screen. The well screen is wrapped in a Carriff® well sock. This is an 88-denier polyester fabric used in the industry for more than 30 years, which provides a pore size that is effective at passing small silts and remaining clear in various formations. Other wraps are available for use (e.g., stainless-steel mesh); however, these were not required based on the design for this project.

To accommodate a moderate amount of data density, eight well screens were used per well system. To cover the selected portion of the plume, well screens were 10 feet in length and spaced 35 feet apart. This spacing and construction dictate the rest of the dimensions to the surface.

### *5.4.1.2 VWS well risers*

A typical cross-section diagram with the approximate build structure is shown on Figure 18, below. The well screens are attached to well risers to extend to the surface (not individually shown due to scale). These risers are HDPE and are continuous in nature (no couplers, joints, or welds are typically used). The size and thickness of the HDPE is dependent on the flow and pressures the project requires. Well riser diameters range from 0.375-inch outer diameter (OD) to 1.5-inch OD. For sampling, usually 0.5-inch OD is suitable. In this case, to add an insert for tracer injection, a larger size was needed. A riser consisting of 0.75-inch OD tubing with wall thickness of 0.0625-inch was used.

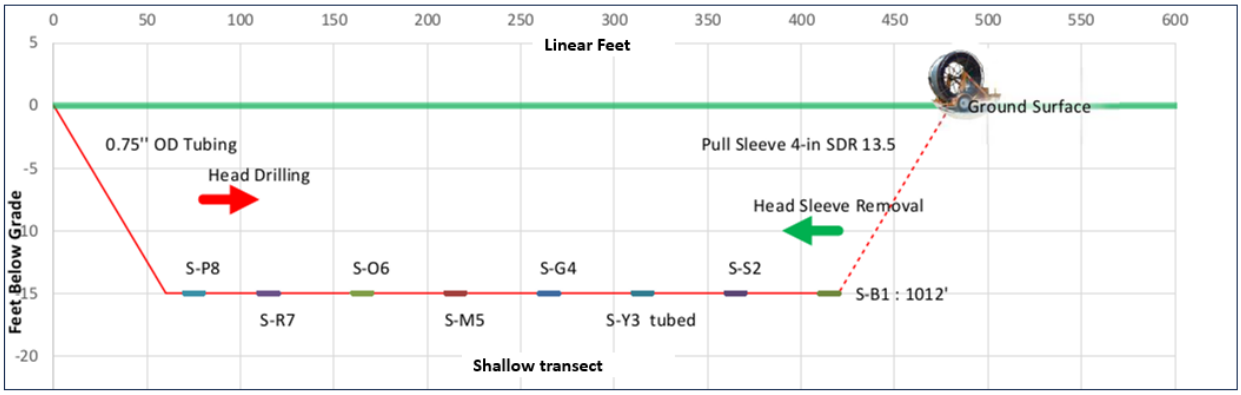



**Figure 18. Shallow Transect VWS Cross-Section Diagram**

### *5.4.1.3 A-DTS Fiber Optic Cable*

A fiber optic cable was co-installed with the shallow VWS transect system to allow both groundwater chemistry and flux to be measured from a single installation. However, certain complexities exist with this approach, such as control of placement of the composite cable within the system and variations in materials surrounding the cable (e.g., VWS tubing), which variably affect the heat transfer from the cable, increasing the uncertainty to quantify groundwater flux (Figure 19, below).

To assess the degree of uncertainty and to maximize the likelihood of quantifying flux, two other cable deployments were completed for this project: a stand-alone cable installation in a parallel horizontal borehole adjacent to the VWS and four direct-push vertical stand-alone installations along a transect perpendicular to the flow direction paired with other vertical characterization profiles (e.g., Geoprobe HPT/VAP sampling), sediment cores, and an MLS for temporal monitoring and sampling (see Section 5.2). These additional stand-alone cable installations remove the complications of the cable placement with the VWS and variable thermal influence of well materials and provide a basis of comparison for the results from the VWS installation. Similar direct-push deployments have shown success at quantifying groundwater flux in sandy aquifers (Bakker et al. 2015; des Tombe et al. 2019). An additional application of the A-DTS method includes assessment of the grout seals between well screens in the VWS, as discussed further in the performance evaluation section for Qualitative Performance Objective #2.

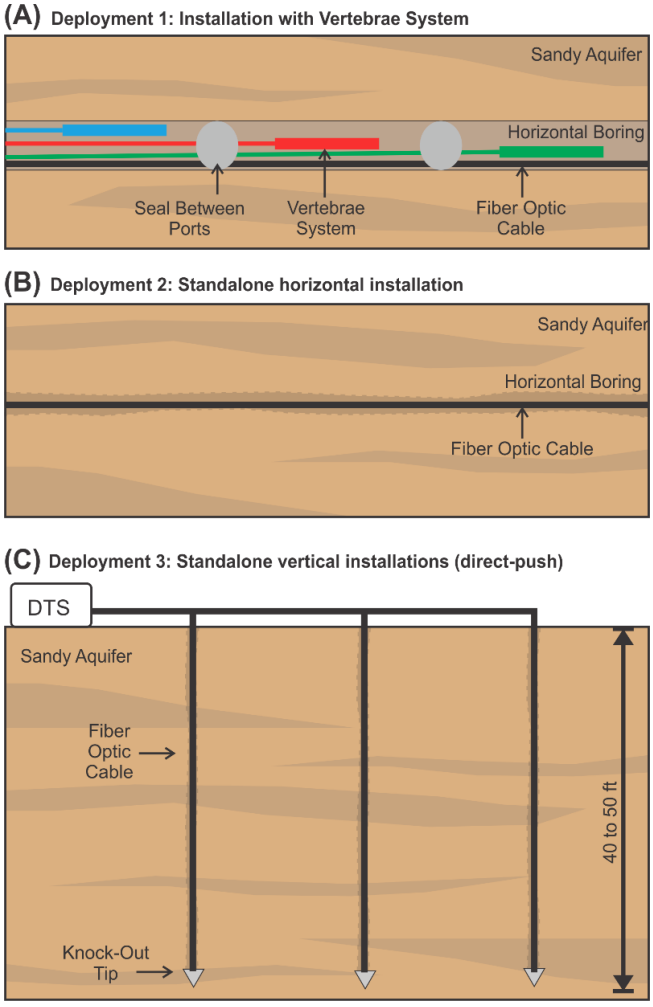



**Figure 19. Fiber Optic Cable Installations**

*Three different fiber optic cable installations were completed: (A) Cable installed with the VWS in the same hole, (B) Cable installed in a separate horizontal borehole, and (C) A series of cables installed in stand-alone vertical holes using direct-push methods. These vertical cables are connected at the surface to allow simultaneous temperature monitoring in all boreholes. In all three deployments, it was assumed the sediment would collapse providing direct contact between the sediment and cable.*

For the horizontal installation with the shallow VWS transect system, the fiber optic cable was added to the well assembly as it was manufactured. Both ends of the fiber optic cable are accessible at the surface and connectors and cable terminations were completed at the surface after the cables were deployed. For the stand-alone horizontal fiber optic cable installation, the cable required a semi-rigid HDPE tubing to aid installation of the cable through the boring; this tubing was removed once the cable was in place. The cable ends were completed at the surface in the same manner as the cable installed with the shallow VWS transect system.

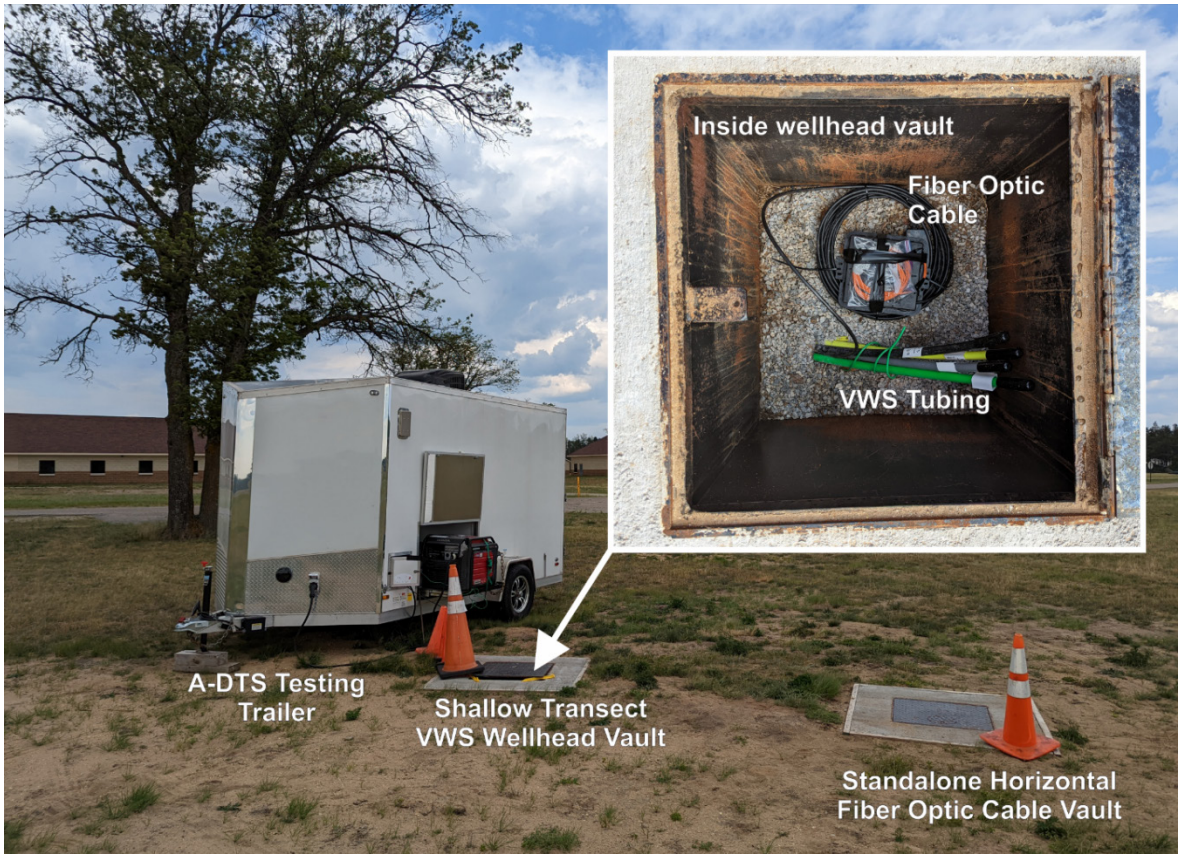



**Figure 20. Field Photos of Horizontal Fiber Optic Cable Installations for A-DTS Testing**

#### *5.4.1.4 Tracer Wire*

The well system is typically built with a polyester pull tape, often called mule tape. The pull tape has foot markings to allow easy build and field measurement to locate the well positions. The well screens are attached to the pull tape during manufacturing. For this project, the pull tape was replaced with a tracer wire as an upgrade to provide additional locating capability and additional assurance that the well materials are PFAS-free.

A tracer wire was included with the VWSs to provide post-installation locating capability. A high-strength copper clad steel tracer wire (Pro-Trace HDD-CCS PE45) was attached to the outside of each VWS from entrance to exit. The tracer wire is visible on Figure 20, above, inside the wellhead vault (thin green wire wrapped around the VWS tubing). The tracer wires can be used to locate the VWSs using inductive line tracing methods. A frequency can be applied by a transmitter to the horizontal well tracing wire, which permits well location using a receiver.

This will allow the locations to be marked prior to future subsurface activities such as drilling or excavation, to avoid damage to the VWSs. In addition, the tracer wires were used to verify accurate and reliable placement of the VWSs in the subsurface, which is one of the quantitative performance objectives.

Inclusion of the Pro-Trace tracer wire is also advantageous because it has length markings; therefore, a separate measuring tape is not necessary. Previous VWS installations included a nylon pull tape for measuring the well systems. As discussed in Section 5.3, 6:2-FTS was initially detected in the measuring tape sample. The use of the Pro-Trace tracer wire instead of the nylon measuring tape provided additional assurance the well materials were PFAS-free.

#### *5.4.1.5 Grout Lines*

Grout lines were built into the VWSs to allow easy tremie-style grouting during installation. These are located per the design at the intended spaced locations, including between each screen and at each end of the VWS. Grout lines generally consist of 0.5-inch OD HDPE pipe. Additional HDPE lines could be incorporated into the VWS design for additional purposes if desired. For example, if a fiber optic cable needed to be inserted after installation (but before grouting or development), it could be threaded into the additional line and then the line could be removed, leaving the fiber optic safely in place.

#### *5.4.1.6 Protective Sleeve*

The sleeve is the outer protective element of the well build. It aides in the build process and protects the well system when spooled and shipped; it also protects the well system during the installation process. Well sleeves are generally typical HDD conduits specified as 13.5 SDR HDPE pipe. EN Rx uses 3-, 4-, 5-, and 6-inch sleeves for construction. The larger sizes have more tensile strength and allow more internal well structures to be used but also require larger drill bits sizes and drill rig sizes to be installed. Larger sleeves also take up more room when shipping. For this project 4-inch HDPE sleeves were used for the three VWSs.

### 5.4.2 Bore Path Design

Drilling was performed using standard HDD, which is a mud rotary drilling method. The wells are double-ended, meaning that a pilot bore was directionally drilled starting at an entry pit and ending at an exit pit. Drilling commenced at the entry pit, proceeded at an angle to the target depth, continued horizontally, and then ascended to the surface at the exit pit. The pilot bore was then reamed to final diameter, and the well materials (or fiber optic cable) were pulled back from the exit end.

The VWS and other features must be placed at locations and depths suitable for the data and goals to be achieved. To ensure this is achieved, a detailed bore path design was completed to specify target depths and distances. Vermeer® Projects (software package) was used to design the bore path. This program accounts for the drilling capabilities, which include initial angles of advancement, rod flex, exit angles, and total distance. Figure 21, below, is a screen shot from this program representing the final bore path design. Once the program output was completed, the target locations and rod-by-rod specifications were downloaded into the drilling console for use by the drilling team.

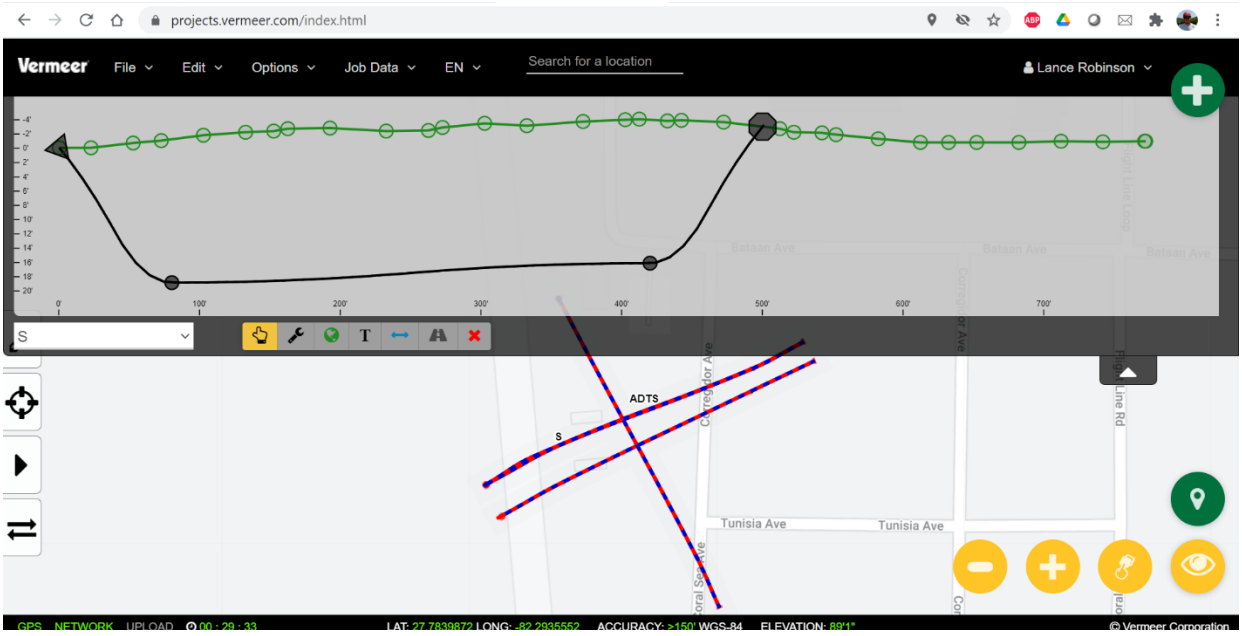



**Figure 21. Bore Path Design Diagram**

### 5.4.3 Drilling and Reaming Operations

Prior to drilling, points along each bore were surveyed and marked with wooden stakes. During drilling, the position of the drill bit was located every 10 feet (when a new rod was added to the drill string). A flag was used to mark the actual position of the bore, to allow comparison between horizontal and vertical position of the proposed and actual points.

Batches of bentonite-based drilling fluid were mixed before and during drilling as needed. The drilling fluid mixture for the project consisted of approximately three 50-pound bags of TRU-Bore® and 32 oz of soda ash to buffer/adjust the pH per 500 gallons of water. This mixture was used for the installation of the stand-alone fiber optic cable and for the first 80 feet of the shallow transect. During drilling of the shallow transect, fluid circulation was lost from 50 to 80 feet into the bore (total of 300 gallons of drilling fluid mixture). The loss of fluid flow was attributed to a change in lithology (apparent small cobble was encountered). The fluid mixture formulation was then adjusted to include 2 pounds of Xanthan gum per 500 gallons of drilling fluid mixture. This mixture was used to complete the shallow transect, deep transect, and longsect. The following is the total drilling fluid used for the completion of each bore:

- Stand-alone fiber optic cable: 3,000 gallons
- Shallow transect: 5,400 gallons
- Deep transect: 5,050 gallons
- Longsect: 5,100 gallons.

For each bore, the drill string entered the ground in the previously excavated entry pit. Drilling was accomplished by affixing the downhole drill head assembly to a rig-mounted drill rod, then pushing the assembly into the ground, alternately rotating and pushing without rotation to follow the desired bore path. The drill head assembly used a 5.5-inch, paddle-style drill bit suitable for sandy material for piloting and reaming a 6-inch bore. As the drilling proceeded, additional rods

were added to the drill string autonomously from the rod rack. While drilling, the driller and locating technician worked in coordination to steer the downhole assembly along the design azimuth and bore path, rotating and pushing as typical for HDD technology.

A walkover locating system was used to track the drill head during pilot bore drilling. For this project a DCI F5+ Falcon® locator was used, which includes state-of-the-art range and radio frequencies as well as drill head pressure sensors. The technology uses a sonde housed behind the drill head, which transmits a wireless radio signal (radiofrequency [RF]). A handheld receiver is then used at the surface to determine location, depth, and orientation of the drill head. This information is communicated to the driller via a rig display so the trajectory of the pilot bore can be continuously adjusted as needed to maintain the desired bore path. The walkover locating system requires surface access along the bore path and the specified equipment provided accuracy measurement within 3% of borehole depth, according to the manufacturer. The maximum depth of walkover locating technology is typically 80 feet, although newer higher end tools give capabilities up to 200 feet in some settings. Walkover locating was suitable for this project due to a maximum depth of the VWS installations being 30 feet, no obstructions at the surface, and no electromagnetic interference encountered.

### 5.4.4 VWS Installations

VWS installation is unique compared to other horizontal well installations. Generally, the well systems are built inside a sleeve (conduit as typical for HDD utility installation practices) and then spooled for shipment to the project site. The sleeve is pulled into the ground and has a high tensile strength, allowing for installation. This allows the internal components of the well system to be more fragile and for larger and latitudinal openings on the well screens. Once the well system is in the correct location for the project, the sleeve is removed, allowing the natural formation to collapse around it. This method offers three major additional benefits for well installation: mud removal via physical displacement of the drilling materials, more complete borehole wall collapse and breakdown of the bore skin, and protection of the well materials from occlusions and damage due to physical movement through the bore. These benefits offer a superior installation to traditional horizontal well installation as evidenced by quick and clear well development.

VWS installation commenced after the bore was properly drilled and the drill bit exited the ground on the terminal end of the bore. Based on drilling conditions and at the driller's discretion, a separate reaming pass to enlarge the borehole to 8 inches was completed prior to pullback of the VWS shallow transect and the longsect well materials. At the deep transect, a separate back reaming pass was not completed prior to pullback of well materials. Once the borehole was ready, the well system was attached to the paddle bit or back-reamer using a swivel and conduit head puller (a device built to expand inside a conduit to grip it internally so it can be pulled into the ground). Once attached properly, the drill rig operator back-reamed or retrieved the drill rod set, rod by rod, transgressing back through the bore to the entrance. Once the sleeve was completely inside the bore, the pull head was removed, and the well system was detached from any internal fixations. After the sleeve was filled with thinning agent as the first step in well development (see Section 5.4.5), the well system was then anchored so that it would be held in final position while the sleeve was removed. The sleeve was pulled from either the entry or exit location, depending on site logistics and the driller's preference. Once the sleeve was out of the ground, the well system was no longer able to be moved.

### 5.4.5 Well Development

#### *5.4.5.1 Initial Chemical Treatment*

As noted in the previous section, well development started with the introduction of a highly concentrated thinning agent (THINZ-IT®), mixed with fresh water, to induce breakdown of the viscosity of the drilling fluid and wall cake along the borehole. A 5-gallon container of THINZ-IT mixed with 300 gallons of fresh water was pumped into the end each carrier sleeve until full, prior to removal of the sleeves.

The stand-alone fiber optic cable bore consisted of two 0.75-inch conduits (one carrier conduit for housing the fiber optic cable and one for application of the THINZ-IT mixture as it was withdrawn from the bore). No additional borehole/well development was conducted at the stand-alone fiber optic cable location. Additional VWS well development activities conducted after removal of each carrier conduit are summarized below.

#### *5.4.5.2 Additional Chemical Treatment and Mixing*

The following activities were performed after removal of the sleeves:

- Five gallons of THINZ-IT mixed with 300 gallons of fresh water were introduced to the four well segments at the western end (shallow and deep transects) or northern end (longsect) of the well system, using a four-channel manifold.
- The four western or northern well segments were agitated with air for approximately 25 minutes using a 185 cubic foot per minute (CFM) air compressor.
- Five gallons of THINZ-IT mixed with 300 gallons of fresh water were introduced to the four well segments at the eastern end (shallow and deep transects) or southern end (longsect) of the well system, using a four-channel manifold.
- The four eastern or southern well segments were air agitated for approximately 25 minutes using a 185 CFM air compressor.

#### *5.4.5.3 Initial Pumping*

Once the appropriate residence time was allowed for the chemical solution to break the viscosity of the drilling fluid, a vacuum trailer capable of providing up to 20 inches of mercury was used to extract fluid from the well segments. Fluid was extracted first from one end of the well system then from the other end, using the same four-channel manifold:

- Shallow transect:
  - The western well segments yielded approximately 60 gallons in 30 minutes of pumping. The black well segment produced very little water.
  - The eastern well segments yielded approximately 60 gallons in 30 minutes of pumping. The red and purple segments produced very little water.
- Deep transect:
  - The western well segments yielded approximately 50 gallons in 30 minutes of pumping. The blue, silver, and yellow well segments produced very little water.

  - The eastern well segments yielded approximately 50 gallons in 30 minutes of pumping. The red and purple well segments produced very little water.
- Longsect:
  - The northern well segments yielded approximately 110 gallons in 1 hour of pumping. The black and silver segments produced very little water after approximately 15 minutes.
  - The southern well segments yielded approximately 75 gallons in 30 minutes of pumping. The red and baby blue segments stopped producing water after approximately 20 minutes.

#### *5.4.5.4 Final Chemical Treatment*

The low-yielding well segments listed above are atypical for the lithology. Therefore, it was determined that the xanthan gum added to the drill mud mixture needed additional breakdown/ development using an acid or an enzyme additive. Acid (muriatic) was readily available and was chosen for additional breakdown (thinning).

It should be noted that xanthan gum is rarely needed for installations unless cobble is present or other atypical conditions. Therefore, development of the well system does not typically include chemical treatment and the additional development that follows.

Initially, a mixture of 2 gallons of muriatic acid and 8 gallons of water for a total volume of 10 gallons was injected into the four eastern deep transect well segments. The mixture was allowed to set for approximately 2 hours. Minimal affect was noted. The concentration of the acid solution was then increased to 2 gallons of muriatic acid and 3 gallons of water for a total of 5 gallons.

Five gallons of this mixture were then injected into each of the 24 independent well segments contained in the shallow transect, deep transect, and longsect, and allowed to set for 24 hours.

#### *5.4.5.5 Final Pumping*

Fluid was extracted first from one end of the well system then from the other end, using the four channel manifold (see Figure 22, below):

- Shallow transect:
  - The western well segments yielded approximately 330 gallons in 2 hours of pumping.
  - The eastern well segments yielded approximately 330 gallons in 2 hours of pumping.
- Deep transect:
  - The western well segments yielded approximately 330 gallons in 2.5 hours of pumping. The silver well segment produced less water than the others.
  - The eastern well segments yielded approximately 330 gallons in 2.5 hours of pumping.
- Longsect:
  - The western well segments yielded approximately 330 gallons in 1 hour of pumping.
  - The eastern well segments yielded approximately 330 gallons in 1 hour of pumping.

The process appeared to allow all well segments to be freely pumping groundwater at acceptable rates upon completion. Most of the well segments purged a clear color. Also, the pH was measured and appeared to be returning to normal values. Groundwater flux through time along with purging during groundwater sampling will aid the overall completeness of well development. Lower than expected pumping rates and low pH values will indicate the need for possible additional purging to ensure the samples collected are representative. It is our experience that each site is different with respect to the amount of time and the amount of development necessary for truly representative groundwater sample results. One would expect that more permeable soil would allow quick development, but the well development effort is also a function of how much penetration into the formation was made by the drilling fluid. Therefore, data collected during hydraulic testing and sampling were evaluated to confirm development objectives had been achieved.

### 5.4.6 Grouting Operations

After development, the grout lines were attached to a GP350 Geoprobe® grout pump (Figure 22, below). The bentonite and Portland-based expanding grout was added to the pump hopper to facilitate injection into the grout tremie lines. The volumes are added to provide an approximate seal size determined appropriate for the site. For this project, given the spacing between segments, 5-foot seals were installed. Approximately 1.8 gallons per foot were used for seal volume, or 9 gallons total per seal.



**Figure 22. Photographs of Well Development and Grouting**

*Pumping at north end of longsect VWS using manifold (left). Grout injection using tremie lines at east end of shallow transect VWS (right).*

### 5.4.7 Wellhead Completions

Additional finishing tasks include labelling the well systems and installing protective vaults. The systems were labelled with heat-shrink printed labels that provide clear legible notation resistant to fading and extreme conditions. Typical nomenclature indicating the system number, the channel number and color (e.g., A-5S, system A, channel 5 silver) was used. Ten colors were used, which allow easy identification and alpha numeric numbering that is unique.

A total of six 2- x 2- x 2-foot flush-mount vaults were installed (Figure 23, below). Gravel base was placed below the well vault skirts for support. The vaults were finished with a concrete apron measuring approximately 1 foot wide and 4 inches thick. The tubing was coiled inside the vault for future use.




**Figure 23. Well Completion and Waste Storage**

*Well completion with flush-mount vault set in concrete (left). Storage containers for HDD waste (right).*

### 5.4.8 Solid and Liquid Waste Management

Waste from HDD operations and well development (Figure 23, above) were managed as two separate waste streams: solid waste and liquid waste. Cuttings and drilling fluid returns from the directional borings accumulated in the entry and exit pits throughout the drilling process. The drilling slurry waste was removed as necessary and transferred to lined 20-cubic yard roll-off containers for off-site landfill disposal, because the large volume generated was not suitable for surface spreading on site. Due to the high liquid content, the drilling slurry was solidified by mixing with a drying agent. Waste characterization samples were then collected from each roll-off container and submitted for laboratory analysis. The laboratory results were submitted to the landfill as part of the waste profile application. A total of 38 tons of solidified drilling slurry were transported to the landfill for disposal.

Approximately 2,125 gallons of liquid waste were pumped from the VWSs during well development and transferred to a vacuum box for storage. This volume was mostly groundwater, with a smaller portion that included the chemical solutions used during development, which would have been diluted when mixing with groundwater in the well segments. The liquid waste was treated for PFAS removal on site using granular activated carbon (GAC). The on-site treatment system consisted of the following components:

- Transfer pump (5 gallons per minute)
- Sediment filter housing with a 5-micron filter cartridge
- Calgon Flowsorb drum with 180 pounds F400 GAC media.

Composite samples were collected before, during, and after treatment and submitted to a laboratory for PFAS analysis. A second treatment pass was required to achieve discharge limits, prior to discharging the treated groundwater to the ground surface and allowing to infiltrate. No PFAS compounds were detected in the effluent after the second treatment pass.

## 5.5 FIELD TESTING

VWS field testing occurred approximately quarterly for 1 year following installation (fourth quarter 2021 through third quarter 2022). Then an additional four events were completed from fourth quarter 2023 through third quarter 2024. Field testing included:

- Collecting groundwater samples from the VWSs, conventional vertical monitoring wells, and the MLS for PFAS laboratory analysis
- Hydraulic testing of the VWSs
- SWTT in the VWSs
- A-DTS testing of the horizontal and vertical fiber optic cables
- Manual water level measurements from the conventional vertical monitoring wells
- High-resolution water level data from pressure transducer dataloggers deployed in the conventional vertical monitoring wells.

The completed project schedule for the VWS installations and field testing is presented in Table 8, below.

**Table 11. Completed Project Schedule**

| | 20Q3 | 20Q4 | 21Q1 | 21Q2 | 21Q3 | 21Q4 | 22Q1 | 22Q2 | 22Q3 | 22Q4 | 23Q1 | 23Q2 | 23Q3 | 23Q4 | 24Q1 | 24Q2 | 24Q3 | 24Q4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Task 1: Site Selection | | | | | | | | | | | | | | | | | | |
| Task 2: Methods Development | | | | | | | | | | | | | | | | | | |
| Task 3: Pre-Design Data Collection | | | | | | | | | | | | | | | | | | |
| Task 4: VWS Installations | | | | | | | | | | | | | | | | | | |
| Task 5: Performance Monitoring | | | | | | | | | | | | | | | | | | |
| Task 6: Reporting, Deliverables, and Technology Transfer | | SSM | G/NG | DP | | | | TT | TT | TT | | | | | | | | FR |
| 1 Year of Additional Performance Monitoring | | | | | | | | | | | | | | | | | | |

**Notes:**
DP = Demonstration Plan (Divine et al. 2021)
FR = Final Report
G/NG = Go/No Go Recommendation Memo (Divine et al. 2021b)
SSM = Site Selection Memo (Divine et al. 2021a)
TT = technology transfer

After all field activities for this project have concluded, the Michigan Army National Guard (MIARNG) has agreed that the VWSs will remain at the GAAF for potential use in evaluating performance of future technology demonstrations designed to treat the soils and groundwater in the Building 1160 source area.

## 5.6 MONITORING METHODS AND RESULTS

Pre-design characterization activities were conducted using vertical drilling methods, prior to installing the VWSs. The results were used to finalize the design of the VWSs (Section 5.2). After the VWSs were installed, monitoring events were conducted approximately quarterly. Select vertical monitoring wells and the MLS CMT well were also included in the monitoring events, for comparison to results from the VWSs.

These data were sufficient to validate the technology performance under real-world conditions and present relevant and significant spatial and temporal variations to complete a thorough evaluation. Table 9, below, describes the number and type of samples that were collected during each phase of this project, along with the analytical methods. Existing site-wide sampling and laboratory procedures were followed to meet the quality assurance requirements. Field duplicates and equipment blanks were included quarterly. All samples were uniquely labelled and documented on chain-of-custody forms. All field activity was recorded in field logs and with photographs.

**Table 12. Total Number and Types of Samples Collected**

| Work Phase | Matrix | Number of Samples | Analysis | Method |
|---|---|---|---|---|
| Vertical characterization | Soil | 31 | PFAS – DoD QSM | LC/MS/MS: USEPA 537 Modified DoD QSM 5.1 |
| | | 8 | PFAS – TOP Assay | TOP assay |
| | | 15 | PFAS – LC-QTOF | LC-QTOF mass spectroscopy |
| | | 50 (U. Guelph, from golden spike boring) 15 (contract lab, splits from golden spike boring, other borings) | Grain Size | ASTM International (ASTM) Method D6913/D6913M-17 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis (or equivalent method) |
| | GW | 41 | PFAS - DoD QSM | LC/MS/MS:[a] USEPA 537 Modified DoD QSM 5.1 |
| Performance monitoring – First four events | GW | 208 | PFAS – DoD QSM | LC/MS/MS:[a] USEPA 537 Modified DoD QSM 5.1 |
| Performance monitoring – Four additional events | GW | 123 | PFAS – DOD QSM | LC/MS/MS:[a] USEPA Method 1633 |

**Notes:**
[a] LC/MS/MS = liquid chromatography with tandem mass spectroscopy
1. Performance monitoring count includes eight quarterly events for VWS, CMT well system, and monitoring wells.
2. Grain-size analysis counts include samples collected at two additional continuous core locations in addition to splits from the golden spike boring submitted to the contract lab.
3. Sample counts above include QA/QC samples.
GW = groundwater
QSM = quality systems manual

Monitoring methods and results from various field activities conducted after the VWSs were installed are presented in Sections 5.6.1 through 5.6.8.

### 5.6.1 VWS Sampling

VWSs are sampled using typical monitoring well sampling techniques. For shallow water table elevations, a peristaltic pump can be used and can be attached directly to the well riser for smaller diameter risers or a separate sampling line can be inserted for larger diameter risers. For deeper systems, a Waterra inertial pumping system or a gas drive pumping system such as a double-valve pump or small-diameter bladder pump can be used for sampling.[4,5,6]

Other suitable pump options are also available, depending on the specific VWS design parameters. Well volumes can be calculated to determine required purge volumes and monitoring of field parameters (e.g., dissolved oxygen, pH, redox potential, electrical conductivity) can be used to confirm the water quality is stable prior to sample collection. Usually, a nearby monitoring well is sufficient to estimate water table elevation for well volume calculations. This method of gauging a nearby monitoring well was utilized to determine well volumes for this project. Depth to water cannot be measured precisely using depth-to-water tapes in the horizontal VWS ports; however, static vacuum can be an indicator of approximate water table elevation. Static vacuum can be measured by drawing water to the surface using a peristaltic pump (or others) and closing the line or stopping the pump and allowing the system to equalize. The static vacuum in the line, measured with a vacuum gauge or manometer, is equivalent to the water table depth. The term static vacuum is used to emphasize vacuum in the tubing must be allowed to equalize, because the vacuum in the line when the pump is engaged and water is flowing can be significantly different. The measurement is relative to the gauge location and height. Multiple wells can be measured from the same location and gradient across a wells system can be determined. The accuracy of the static vacuum method for measuring groundwater elevation is slightly less than that of current vertical instruments. Sampling activities were completed by local field technicians that are familiar with the MDEQ and sampling protocol. MDEQ has online documents indicating suitable techniques for PFAS sampling.[7]

Groundwater samples were collected from the VWSs quarterly using a peristaltic pump and were analyzed for PFAS. Low-flow sampling methodology consistent with Arcadis' TGI was used to sample the VWSs for PFAS compounds. Geochemical water quality parameters were monitored and recorded during groundwater sampling. Groundwater sampling logs are provided in Appendix I. PFAS groundwater analytical results from the VWSs are presented in Tables 13 and 14 and the laboratory analytical reports are provided in Appendix C.

[4] https://waterra.com/waterra-groundwater-sampling-pump/
[5] https://solinst.com/products/groundwater-samplers/408-double-valve-pumps/
[6] https://www.qedenv.com/en-us/products/sample-pro-low-flow-pneumatic-groundwater-sampling-pump/
[7] https://www.michigan.gov/documents/pfasresponse/Groundwater_PFAS_Sampling_Guidance_637871_7.pdf

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| | Location | CMT-VRTB-01_1 | CMT-VRTB-01_1 | CMT-VRTB-01_2 | CMT-VRTB-01_2 | CMT-VRTB-01_2 | CMT-VRTB-01_2 | CMT-VRTB-01_2 | CMT-VRTB-01_3 | CMT-VRTB-01_3 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Depth Interval (ft bgs) | 15 | 15 | 17 | 17 | 17 | 17 | 17 | 19.5 | 19.5 |
| | Sample Date | 4/1/2024 | 7/18/2024 | 6/14/2022 | 10/23/2023 | 1/22/2024 | 4/1/2024 | 7/18/2024 | 6/14/2022 | 10/23/2023 |
| Analyte | Units | | | | | | | | | |
| **PFAS** | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <18 U | <3.6 U | -- | <4.1 U | <400 U | <36 U | <3.6 U | -- | <3.9 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <18 U | <3.6 U | -- | <4.1 U | <400 U | <36 U | <3.6 U | -- | <3.9 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <110 U | <22 U | -- | <26 U | <2500 U | <230 U | <23 U | -- | <24 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <22 U | <4.4 U | -- | <5.1 U | <500 U | <45 U | <4.6 U | -- | <4.8 U |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <110 U | <22 U | -- | <26 U | <2500 U | <230 U | <23 U | -- | <24 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <18 U | <3.6 U | -- | <4.1 U | <400 U | <36 U | <3.6 U | -- | <3.9 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <18 U | <3.6 U | <7.0 U | <4.1 U | <400 U | <36 U | <3.6 U | <6.9 U | <3.9 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <22 U | <4.4 U | **100** | **140** | **320 J** | **120 M-03** | **91** | **17** | **37** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <18 U | <3.6 U | **54** | **37 M-03** | <400 U | **28 JM-03** | **59** | <6.9 U | **24** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <18 U | <3.6 U | -- | <4.1 U | <400 U | <36 U | <3.6 U | -- | <3.9 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <4.5 U | <0.89 U | -- | <1 U | <100 U | <9.0 U | <0.91 UQ | -- | <0.97 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <45 U | <8.9 U | -- | <10 UQM-03 | <1000 U | <90 U | <9.1 UQ | -- | <9.7 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <4.5 U | <0.89 U | <7.0 U | <1 U | <100 U | <9.0 U | <0.91 U | <6.9 U | <0.97 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <4.5 U | <0.89 U | <14 U | <1 U | <100 U | <9.0 U | <0.91 UQ | <14 U | <0.97 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <45 U | <8.9 U | -- | <10 UQM-03 | <1000 U | <90 U | <9.1 UQ | -- | <9.7 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <4.5 U | <0.89 U | <7.0 U | <1 UQ | <100 U | <9.0 U | <0.91 U | <6.9 U | <0.97 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <8.9 U | <1.8 U | -- | <2.1 U | <200 U | <18 U | <1.8 U | -- | <1.9 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <8.9 U | <1.8 U | -- | <2.1 U | <200 U | <18 U | <1.8 U | -- | <1.9 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <8.9 U | <1.8 U | -- | <2.1 U | <200 U | <18 U | <1.8 UM-03 | -- | <1.9 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <8.9 U | <1.8 U | -- | <2.1 U | <200 U | <18 U | <1.8 U | -- | <1.9 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **55** | **21** | **50** | **54** | **44 JM-03** | **20 M-03** | **30** | **17** | **14** |
| Perfluorobutanoic acid (PFBA) | ng/l | **16 J** | **31** | **48 B** | **120** | **110 J** | **41** | **30** | **43 B** | **49** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <4.5 U | <0.89 U | <680 UH | <1 U | <100 U | <9.0 U | <0.91 U | <3.4 U | <0.97 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <4.5 U | <0.89 U | <3.5 U | **0.38 J** | <100 U | <9.0 U | **0.49 JM-03** | <3.4 U | <0.97 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <4.5 U | <0.89 U | -- | <1 U | <100 U | <9.0 U | <0.91 U | -- | <0.97 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <4.5 U | <0.89 U | <3.5 U | <1 U | <100 U | <9.0 U | <0.91 U | <3.4 U | <0.97 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **8.0** | **8.0 M-03** | **230** | **430 M-03** | **240 M-03** | **180** | **490** | **18** | **73** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **73** | **130** | **130** | **240** | **330** | **100 M-03** | **67** | **72** | **88** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **50 M-03** | **150** | **3500 H** | **3800 M-03** | **5300 M-03** | **2100 M-03** | **2200 M-03** | **730 H** | **870 M-03** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **39** | **75** | **330** | **480** | **430** | **190** | **180** | **160** | **150** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <4.5 U | <0.89 U | <680 UH | **1.2 M-03** | <100 U | <9.0 U | **1.4 M-03** | <3.4 U | **0.15 JM-03** |
| Perfluorononanoic acid (PFNA) | ng/l | **11 M-03** | **4.0 M-03** | **77 H** | **85 M-03** | **120 M-03** | **73 M-03** | **120 M-03** | **16** | **37 M-03** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <4.5 U | **0.25 JM-03** | **0.88 J** | **3 JM-03** | <100 U | **1.9 JM-03** | <9.1 U | <3.4 U | **0.72 JM-03** |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **1300 M-03** | **560 M-03** | **33000 H** | **26000 HSM-03** | **31000 M-03** | **30000 BHM-03** | **37000 HM-03** | **2300 H** | **7500 HM-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **140** | **250 M-03** | **240** | **330 M-03** | **630 M-03** | **330 M-03** | **190 M-03** | **58** | **110 M-03** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **1.9 JM-03** | **6.5** | **120** | **180** | **110 M-03** | **46 M-03** | **81** | **30** | **29** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **40** | **75** | **130 B** | **270** | **280 M-03** | **100 M-03** | **65** | **98 B** | **110** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <4.5 U | <0.89 U | <3.5 U | <1 U | <100 U | <9.0 U | <0.91 U | <3.4 U | <0.97 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <4.5 U | <0.89 U | <3.5 U | <1 U | <100 U | <9.0 U | <0.91 U | <3.4 U | <0.97 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <4.5 U | <0.89 U | <3.5 U | <1 U | <100 U | <9.0 U | <0.91 U | <3.4 U | <0.97 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

**Table 13**
**PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs**
**ESTCP Final Report**
**Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge**
**Grayling, Michigan**

| | Location | CMT-VRTB-01_3 | CMT-VRTB-01_3 | CMT-VRTB-01_3 | CMT-VRTB-01_4 | CMT-VRTB-01_4 | CMT-VRTB-01_4 | CMT-VRTB-01_4 | CMT-VRTB-01_4 | CMT-VRTB-01_4 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Depth Interval (ft bgs) | 19.5 | 19.5 | 19.5 | 23 | 23 | 23 | 23 | 23 | 23 |
| | Sample Date | 1/22/2024 | 4/1/2024 | 7/18/2024 | 6/14/2022 | 8/25/2022 | 10/23/2023 | 1/22/2024 | 4/1/2024 | 7/18/2024 |
| **Analyte** | **Units** | | | | | | | | | |
| **PFAS** | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <80 U | <3.8 U | <3.6 U | -- | -- | <4.1 U | <3.9 UH | <3.8 U | <3.6 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <80 U | <3.8 U | <3.6 U | -- | -- | <4.1 U | <3.9 UH | <3.8 U | <3.6 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <500 U | <23 U | <22 U | -- | -- | <26 U | <24 UH | <24 U | <22 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <100 U | <4.7 U | <4.5 U | -- | -- | <5.1 U | <4.9 UH | <4.8 U | <4.5 U |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <500 U | <23 U | <22 U | -- | -- | <26 U | <24 UH | <24 U | <22 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <80 U | <3.8 U | <3.6 U | -- | -- | <4.1 U | <3.9 UH | <3.8 U | <3.6 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <80 U | <3.8 U | <3.6 U | <6.7 U | **4.9 J** | <4.1 U | <3.9 UH | <3.8 U | <3.6 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <100 U | **21** | **16** | **1.7 J** | **1100** | **13** | **7.3 H** | **27** | **8.7** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **12 JM-03** | **16 M-03** | **16** | <6.7 U | **220** | <4.1 U | <3.9 UHL | <3.8 U | **0.87 JM-03** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <80 U | <3.8 U | <3.6 U | -- | -- | <4.1 U | <3.9 UH | <3.8 U | <3.6 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <20 U | <0.94 U | <0.90 U | -- | -- | <1 U | <0.98 UH | <0.96 U | <0.89 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <200 U | <9.4 U | <9.0 U | -- | -- | <10 U | <9.8 UH | <9.6 U | <8.9 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20 U | <0.94 U | <0.90 U | <6.7 U | <7.1 U | <1 U | <0.98 UH | <0.96 U | <0.89 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <20 U | <0.94 U | <0.90 U | <13 U | <14 U | <1 U | <0.98 UH | <0.96 U | <0.89 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <200 U | <9.4 U | <9.0 U | -- | -- | <10 U | <9.8 UH | <9.6 U | <8.9 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20 U | <0.94 U | <0.90 U | <6.7 U | <7.1 U | <1 U | <0.98 UH | <0.96 U | <0.89 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <40 U | <1.9 U | <1.8 U | -- | -- | <2 U | <2 UH | <1.9 U | <1.8 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <40 U | <1.9 U | <1.8 U | -- | -- | <2 U | <2 UH | <1.9 U | <1.8 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <40 U | <1.9 U | <1.8 U | -- | -- | <2 U | <2 UH | <1.9 U | <1.8 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <40 U | <1.9 U | <1.8 U | -- | -- | <2 U | <2 UH | <1.9 U | <1.8 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **9.8 JM-03** | **6.4 M-03** | **8.0 M-03** | **11** | **23** | **11** | **14 HM-03** | **7.1 M-03** | **7.4** |
| Perfluorobutanoic acid (PFBA) | ng/l | **19 JM-03** | **15** | **16** | **15 B** | **250** | **17** | **12 H** | **13** | **10** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <20 U | <0.94 U | <0.90 U | <3.4 U | <3.6 U | <1 U | <0.98 UH | <0.96 U | <0.89 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <20 U | <0.94 U | <0.90 U | <3.4 U | **8.3** | <1 U | <0.98 UH | <0.96 U | <0.89 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <20 U | <0.94 U | <0.90 U | -- | -- | <1 U | <0.98 UH | <0.96 U | <0.89 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <20 U | <0.94 U | <0.90 U | <3.4 U | <3.6 U | <1 U | <0.98 UH | <0.96 U | <0.89 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **38** | **48** | **39** | **9.3** | **9.5** | **22 M-03** | **21 HM-03** | **24 M-03** | **18** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **47 M-03** | **26** | **30** | **15** | **260** | **28** | **27 H** | **21 M-03** | **15** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **1100 M-03** | **400** | **380** | **280** | **520** | **340 M-03** | **480 H** | **440 M-03** | **220 M-03** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **50** | **27** | **35** | **30** | **660** | **34** | **26 HM-03** | **24** | **19** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <20 U | <0.94 U | <0.90 U | <3.4 U | <3.6 U | <1 U | <0.98 UH | <0.96 U | <0.89 U |
| Perfluorononanoic acid (PFNA) | ng/l | **40 M-03** | **28 M-03** | **31 M-03** | **4.9** | **25** | **9.9 M-03** | **9.2 H** | **13 M-03** | **13 M-03** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <20 U | **0.61 JM-03** | **0.61 JM-03** | **0.92 J** | <3.6 U | <1 U | <0.98 UH | <0.96 UM-03 | <0.89 UM-03 |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **7000 M-03** | **5600 BHM-03** | **5100 HM-03** | **730 Q** | **620** | **1200 M-03** | **1500 M-03** | **1300 M-03** | **1600 BM-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **110 M-03** | **63 M-03** | **49 M-03** | **29** | **170** | **41 M-03** | **49 H** | **67 M-03** | **28** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **17 J** | **8.6 M-03** | **13** | **15** | **19** | **17** | **16 H** | **10 M-03** | **11** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **33 J** | **26** | **27** | **21** | **1000** | **27** | **16 H** | **18** | **15** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <20 U | <0.94 U | <0.90 U | <3.4 U | <3.6 U | <1 U | <0.98 UH | <0.96 U | <0.89 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <20 U | <0.94 U | <0.90 U | <3.4 U | <3.6 U | <1 U | <0.98 UH | <0.96 U | <0.89 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <20 U | <0.94 U | <0.90 U | <3.4 U | <3.6 U | <1 U | <0.98 UH | <0.96 U | <0.89 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | CMT-VRTB-01_5 | CMT-VRTB-01_5 | CMT-VRTB-01_5 | CMT-VRTB-01_5 | CMT-VRTB-01_5 | CMT-VRTB-01_5 | CMT-VRTB-01_6 | CMT-VRTB-01_6 | CMT-VRTB-01_6 |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | 26.5 | 26.5 | 26.5 | 26.5 | 26.5 | 26.5 | 30.5 | 30.5 | 30.5 |
| Sample Date | | 6/14/2022 | 8/25/2022 | 10/23/2023 | 1/22/2024 | 4/1/2024 | 7/18/2024 | 6/14/2022 | 8/25/2022 | 10/25/2023 |
| Analyte | Units | | | | | | | | | |
| **PFAS** | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | -- | -- | <4 U | <3.8 UH | <3.8 U | <3.6 U | -- | -- | <4 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | -- | -- | <4 U | <3.8 UH | <3.8 U | <3.6 U | -- | -- | <4 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | -- | -- | <25 U | <24 UH | <24 U | <22 U | -- | -- | <25 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | -- | -- | <5 U | <4.8 UH | <4.8 U | <4.5 UL | -- | -- | <5 U |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | -- | -- | <25 U | <24 UH | <24 U | <22 U | -- | -- | <25 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | -- | -- | <4 U | <3.8 UH | <3.8 U | <3.6 U | -- | -- | <4 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <6.7 UH | <7.0 U | <4 U | <3.8 UH | <3.8 U | <3.6 U | <6.9 UQ | <7.0 U | <4 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <6.7 UHQ | <7.0 U | <5 U | <4.8 UH | <4.8 U | <4.5 U | <6.9 UQ | <7.0 U | <5 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <6.7 UH | <7.0 U | <4 U | <3.8 UHL | <3.8 U | <3.6 U | <6.9 U | <7.0 U | <4 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | -- | -- | <4 U | <3.8 UH | <3.8 U | <3.6 U | -- | -- | <4 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | <1 U | <0.96 UH | <0.95 U | <0.90 U | -- | -- | <1 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | <10 U | <9.6 UH | <9.5 U | <9.0 U | -- | -- | <10 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <6.7 UH | <7.0 U | <1 U | <0.96 UH | <0.95 U | <0.90 U | <6.9 U | <7.0 U | <1 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <13 UH | <14 U | <1 U | <0.96 UH | <0.95 U | <0.90 U | <14 U | <14 U | <1 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | <10 U | <9.6 UH | <9.5 U | <9.0 U | -- | -- | <10 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <6.7 UH | <7.0 U | <1 U | <0.96 UH | <0.95 U | <0.90 U | <6.9 U | <7.0 U | <1 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | <2 U | <1.9 UH | <1.9 U | <1.8 U | -- | -- | <2 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | <2 U | <1.9 UH | <1.9 U | <1.8 U | -- | -- | <2 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | <2 U | <1.9 UH | <1.9 U | <1.8 U | -- | -- | <2 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | <2 U | <1.9 UH | <1.9 U | <1.8 U | -- | -- | <2 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **9.3 H** | **9.8** | **8.2** | **12 HM-03** | **7.4** | **9.2 M-03** | **10** | **9.3** | **9.1** |
| Perfluorobutanoic acid (PFBA) | ng/l | **10 H** | **11** | **10** | **12 HM-03** | **9.6** | **10** | **16** | **12** | **9.2** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <3.4 UH | <3.5 U | <1 U | <0.96 UH | <0.95 U | <0.90 U | <3.5 U | <3.5 U | <1 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <3.4 UH | <3.5 U | <1 U | <0.96 UH | <0.95 U | <0.90 U | <3.5 U | <3.5 U | <1 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | <1 U | <0.96 UH | <0.95 U | <0.90 U | -- | -- | <1 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <3.4 UH | <3.5 U | <1 U | <0.96 UH | <0.95 U | <0.90 U | <3.5 U | <3.5 U | <1 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **4.7 H** | <3.5 U | **8.1** | **11 H** | **7.5 M-03** | **8.0** | **7.2** | **6.6** | **9.5** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **12 H** | **2.5 J** | **10** | **17 HM-03** | **9.5 M-03** | **11** | **12** | **12** | **9.1** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **190 H** | **48** | **130** | **260 HM-03** | **190 M-03** | **160 M-03** | **220** | **190** | **190 M-03** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **21 H** | **3.6** | **15** | **21 HM-03** | **14 M-03** | **17** | **28** | **23** | **15** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <3.4 UH | <3.5 U | <1 U | <0.96 UH | <0.95 U | <0.90 U | <3.5 U | <3.5 U | <1 U |
| Perfluorononanoic acid (PFNA) | ng/l | **1.2 HJ** | **1.4 J** | **1.7** | **2 H** | **1.8 M-03** | **2.2 M-03** | <3.5 U | <3.5 U | **1.2 M-03** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <3.4 UH | <3.5 U | <1 U | <0.96 UH | <0.95 U | <0.90 U | **1.5 J** | <3.5 U | <1 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **99 H** | **32** | **280 SM-03** | **380 HM-03** | **270 M-03** | **310 BM-03** | **120** | **140** | **370 M-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **21 H** | **11** | **16 M-03** | **27 H** | **20 M-03** | **20 M-03** | **22** | **16** | **19 M-03** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **12 H** | **2.3 J** | **11** | **15 HM-03** | **9.2** | **12** | **17** | **12** | **13** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **16 H** | **4.5** | **12** | **14 H** | **10** | **13** | **20 H** | **14** | **12** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <3.4 UH | <3.5 U | <1 U | <0.96 UH | <0.95 U | <0.90 U | <3.5 U | <3.5 U | <1 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <3.4 UH | <3.5 U | <1 U | <0.96 UH | <0.95 U | <0.90 U | <3.5 U | <3.5 U | <1 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <3.4 UH | <3.5 U | <1 U | <0.96 UH | <0.95 U | <0.90 U | <3.5 U | <3.5 U | <1 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| | Location | CMT-VRTB-01_6 | CMT-VRTB-01_7 | CMT-VRTB-01_7 | MW-VRTB-1D | MW-VRTB-1D | MW-VRTB-1D | MW-VRTB-1D | MW-VRTB-1S | MW-VRTB-1S | MW-VRTB-1S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth Interval (ft bgs) | 30.5 | 36.5 | 36.5 | 26.5-31.5 | 26.5-31.5 | 26.5-31.5 | 26.5-31.5 | 15-20 | 15-20 | 15-20 |
| | Sample Date | 1/22/2024 | 6/14/2022 | 8/25/2022 | 12/13/2021 | 4/13/2022 | 6/14/2022 | 8/24/2022 | 12/13/2021 | 12/13/2021 | 4/13/2022 |
| Analyte | Units | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <3.6 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <3.6 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <22 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <4.4 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <22 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <3.6 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <3.6 UH | <6.8 U | <6.8 U | <7.8 U | <7.1 U | <6.8 U | <6.9 U | <7.7 U | <7.6 U | <7.1 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <4.4 UH | <6.8 UQ | <6.8 U | <7.8 U | <6.9 U | <6.8 U | <6.9 U | **35** | **38** | **270** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <3.6 UHL | <6.8 U | <6.8 U | <7.8 U | <7.1 U | <6.8 U | <6.9 U | **29** | **33** | **66** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <3.6 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <0.89 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <8.9 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <0.89 UH | <6.8 U | <6.8 U | <7.8 U | <7.1 U | <6.8 U | <6.9 U | <7.7 U | <7.6 U | <7.1 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <0.89 UH | <14 U | <14 U | <16 U | <14 U | <14 U | <14 U | <15 U | <15 U | <14 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <8.9 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <0.89 UH | <6.8 U | <6.8 U | <7.8 U | <7.1 U | <6.8 U | <6.9 U | <7.7 U | <7.6 U | <7.1 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <1.8 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <1.8 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <1.8 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <1.8 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **12 HM-03** | **6.1** | **2.1 J** | **5.0** | **9.0** | **9.5** | **7.0** | **14** | **15** | **19** |
| Perfluorobutanoic acid (PFBA) | ng/l | **12 H** | **8.6** | **4.3** | **14** | **13** | **13 B** | **10** | **29** | **29** | **45** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <0.89 UH | <3.4 U | <3.4 U | <3.9 U | <3.6 U | <3.4 U | <3.4 U | <3.8 U | <3.8 U | <3.6 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <0.89 UH | <3.4 U | <3.4 U | <3.9 U | <3.6 U | <3.4 U | <3.4 U | <3.8 U | <3.8 U | <3.6 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <0.89 UH | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <0.89 UH | <3.4 U | <3.4 U | <3.9 U | <3.6 U | <3.4 U | <3.4 U | <3.8 U | <3.8 U | <3.6 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **11 H** | **8.0** | **0.92 J** | **2.9 J** | **6.6** | **6.5** | **4.9** | **55** | **55** | **100** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **12 H** | **8.3** | <3.4 U | **4.8** | **12** | **12** | **9.9** | **73** | **74** | **190** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **150 H** | **160** | **28** | **85** | **190** | **190** | **140** | **1200** | **1300** | **2100** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **21 HM-03** | **13** | **2.4 J** | **13** | **24** | **22** | **14** | **100** | **110** | **200** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <0.89 UH | <3.4 U | <3.4 U | <3.9 U | <3.6 U | <3.4 U | <3.4 U | <3.8 U | <3.8 U | <3.6 U |
| Perfluorononanoic acid (PFNA) | ng/l | **1.1 HM-03** | **7.5** | <3.4 U | <3.9 U | <3.6 U | **0.89 J** | <3.4 U | **36** | **39** | **100** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <0.89 UH | <3.4 U | <3.4 U | <3.9 U | <3.6 U | <3.4 U | <3.4 U | <3.8 U | <3.8 U | <3.6 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **460 HM-03** | **660** | **16** | **58** | **180** | **180** | **170** | **16000** | **16000** | **15000** |
| Perfluorooctanoic acid (PFOA) | ng/l | **17 HM-03** | **17** | **1.7 J** | **6.7** | **21** | **17** | **14** | **110** | **110** | **330 J** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **11 H** | **5.4** | **2.8 J** | **7.0** | **13** | **12** | **9.2** | **34** | **36** | **53** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **15 H** | **6.6 H** | **1.7 J** | **9.5** | **19** | **20 B** | **14** | **76** | **78** | **130** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <0.89 UH | <3.4 U | <3.4 U | <3.9 U | <3.6 U | <3.4 U | <3.4 U | <3.8 U | <3.8 U | <3.6 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <0.89 UH | <3.4 U | <3.4 U | <3.9 U | <3.6 U | <3.4 U | <3.4 U | <3.8 U | <3.8 U | <3.6 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <0.89 UH | <3.4 U | <3.4 U | <3.9 U | <3.6 U | <3.4 U | <3.4 U | <3.8 U | <3.8 U | <3.6 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | MW-VRTB-1S | MW-VRTB-1S | MW-VRTB-2D | MW-VRTB-2D | MW-VRTB-2D | MW-VRTB-2D | MW-VRTB-2D | MW-VRTB-2S | MW-VRTB-2S | MW-VRTB-2S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | 15-20 | 15-20 | 26-31 | 26-31 | 26-31 | 26-31 | 26-31 | 16-21 | 16-21 | 16-21 |
| Sample Date | | 6/14/2022 | 8/24/2022 | 12/27/2021 | 4/13/2022 | 4/13/2022 | 6/14/2022 | 8/24/2022 | 12/27/2021 | 4/13/2022 | 6/14/2022 |
| Analyte | Units | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <6.9 U | <700 U | <8.1 U | <8.1 U | <7.0 U | <6.8 U | <34 U | <8.1 U | <7.1 U | <6.9 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | **150** | <700 U | <8.1 U | <8.1 U | <7.0 U | <6.8 U | <34 U | **20** | **49** | **28** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **52** | <700 U | <8.1 U | <8.1 U | <7.0 U | <6.8 U | <34 U | **9.5** | **18** | **7.6** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <6.9 U | <700 U | <8.1 U | <8.1 U | <7.0 U | <6.8 U | <34 U | <8.1 U | <7.1 U | <6.9 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <14 U | <1400 U | <16 U | <16 U | <14 U | <14 U | <68 U | <16 U | <14 U | <14 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <6.9 U | <700 U | <8.1 U | <8.1 U | <7.0 U | <6.8 U | <34 U | <8.1 U | <7.1 U | <6.9 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **19** | <350 U | **14** | **2.2 J** | **12** | **19** | **9.0 J** | **14** | **12** | **11** |
| Perfluorobutanoic acid (PFBA) | ng/l | **76 B** | <350 U | **15** | **10** | **12** | **19 B** | **18** | **49** | **44** | **33 B** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <3.4 UQ | <350 U | <4.0 U | <4.0 U | <3.5 U | <3.4 U | <17 U | <4.0 U | <3.5 U | <3.4 US |
| Perfluorodecanoic acid (PFDA) | ng/l | <3.4 U | <350 U | <4.0 U | <4.0 U | <3.5 U | <3.4 U | <17 U | <4.0 U | <3.5 U | <3.4 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <3.4 U | <350 U | <4.0 U | <4.0 U | <3.5 U | <3.4 U | <17 U | <4.0 U | <3.5 U | <3.4 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **120** | **110 J** | **13** | **1.6 J** | **18** | **19** | **12 J** | **31** | **69** | **38 S** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **160** | **150 J** | **10** | **17** | **10** | **11** | **11 J** | **110** | **97** | **64** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **1900 H** | **1800** | **290** | **47** | **300** | **350** | **240** | **770** | **1100** | **670** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **250** | **170 J** | **21** | **16** | **21** | **28** | **29** | **140** | **130** | **91 S** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <3.4 UQ | <350 U | <4.0 U | <4.0 U | <3.5 U | <3.4 U | <17 U | <4.0 U | <3.5 U | <3.4 US |
| Perfluorononanoic acid (PFNA) | ng/l | **72 Q** | <350 U | <4.0 U | **1.8 J** | **1.5 J** | **2.4 J** | <17 U | **31** | **56** | **31** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <3.5 U | <350 U | <4.0 U | <4.0 U | <3.5 U | <3.4 U | <17 U | <4.0 U | <3.5 U | <3.4 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **13000 H** | **17000** | **240** | **110** | **320** | **520** | **380** | **9500** | **11000** | **6200** |
| Perfluorooctanoic acid (PFOA) | ng/l | **300** | **370** | **36** | **12** | **47** | **56** | **47** | **84** | **170** | **110 S** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **43** | <350 U | **19** | **1.3 J** | **17** | **24** | **13 J** | **33** | **33** | **22** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **190 B** | **160 J** | **17** | **20** | **19** | **16** | **30** | **130** | **110** | **71** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <3.5 U | <350 U | <4.0 U | <4.0 U | <3.5 U | <3.4 U | <17 U | <4.0 U | <3.5 U | <3.4 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <3.4 U | <350 U | <4.0 U | <4.0 U | <3.5 U | <3.4 U | <17 U | <4.0 U | <3.5 U | <3.4 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <3.4 U | <350 U | <4.0 U | <4.0 U | <3.5 U | <3.4 U | <17 U | <4.0 U | <3.5 U | <3.4 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | MW-VRTB-2S | MW-VRTB-3 | MW-VRTB-3 | MW-VRTB-3 | MW-VRTB-3 | MW-VRTB-3 | VRTB-D-06 | VRTB-D-06 | VRTB-D-06 | VRTB-D-06 | VRTB-D-06 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | 16-21 | 15-20 | 15-20 | 15-20 | 15-20 | 15-20 | Deep | Deep | Deep | Deep | Deep |
| Sample Date | | 8/24/2022 | 12/27/2021 | 12/27/2021 | 4/13/2022 | 6/14/2022 | 8/24/2022 | 12/21/2021 | 4/13/2022 | 6/13/2022 | 8/22/2022 | 10/25/2023 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | <7.9 U | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <4.2 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | -- | -- | -- | -- | -- | -- | -- | <7.9 U | -- | -- | <4.2 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <26 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <5.2 U |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <26 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <4.2 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <680 U | <7.9 U | <7.9 U | <6.9 U | <6.9 U | <34 U | <8.1 U | <7.9 U | <6.9 U | <7.0 U | <4.2 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <680 U | <7.9 U | <7.9 U | <6.9 U | <6.9 U | <34 U | <8.1 U | <7.9 U | <6.9 U | <7.0 U | <5.2 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <680 U | <7.9 U | <7.9 U | <6.9 U | <6.9 U | <34 U | <8.1 U | <7.9 U | <6.9 U | <7.0 U | <4.2 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <4.2 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | -- | -- | -- | -- | -- | <7.9 U | -- | -- | <1 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <10 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <680 U | <7.9 U | <7.9 U | <6.9 U | <6.9 U | <34 U | <8.1 U | <7.9 U | <6.9 U | <7.0 U | <1 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <1400 U | <16 U | <16 U | <14 U | <14 U | <68 U | <16 U | <16 U | <14 U | <14 U | <1 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <10 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <680 U | <7.9 U | <7.9 U | <6.9 U | <6.9 U | <34 U | <8.1 U | <7.9 U | <6.9 U | <7.0 U | <1 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <2.1 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <2.1 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <2.1 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <2.1 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | <340 U | **2.6 J** | **2.7 J** | **4.0** | **1.9 J** | <17 U | **2.1 J** | **2.9 J** | **2.6 J** | **2.4 J** | **2.3** |
| Perfluorobutanoic acid (PFBA) | ng/l | <340 U | **3.7 J** | **3.8 J** | **9.9** | **5.5 B** | **18** | **6.2** | **6.2** | **6.7** | **4.8** | **4.1 J** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <340 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <17 U | <4.1 U | <4.0 U | <3.4 U | <3.5 U | <1 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <340 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <17 U | <4.1 U | <4.0 U | <3.4 U | <3.5 U | <1 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <1 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <340 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <17 U | <4.1 U | <4.0 U | <3.4 U | <3.5 U | <1 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | <340 U | **7.4** | **7.6** | **7.8** | **2.1 J** | **7.6 J** | **6.7** | **7.7** | **5.2** | **4.8** | **7.5** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **110 J** | **4.0** | **3.9 J** | **7.2** | **1.5 J** | **9.4 J** | **5.9** | **5.9** | **5.1** | **5.1** | **5.5** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **610** | **110** | **120** | **110** | **39** | **150** | **81** | **79** | **75** | **79** | **72 M-03** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **100 J** | **10** | **9.2** | **17** | **3.4 J** | **26** | **13** | **9.9** | **9.1** | **9.4** | **9.1** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <340 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <17 U | <4.1 U | <4.0 U | <3.4 U | <3.5 U | <1 U |
| Perfluorononanoic acid (PFNA) | ng/l | <340 U | **7.5** | **7.0** | **7.1** | <3.5 U | **6.8 J** | **1.5 J** | **1.2 J** | **0.97 J** | **0.92 J** | **1.3 M-03** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <340 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <17 U | <4.1 U | <4.0 U | <3.4 U | <3.5 U | <1 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **8600** | **900** | **800** | **530** | **30** | **580** | **310** | **290** | **230** | **240** | **270 M-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **150 J** | **11** | **11** | **16** | **2.1 J** | **22** | **9.1** | **8.8** | **6.0** | **6.1** | **7.7 M-03** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | <340 U | **2.6 J** | **2.8 J** | **3.7** | **3.1 J** | **5.0 J** | **3.7 J** | **4.6** | **4.8** | **4.5** | **4.1** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **110 J** | **5.1** | **4.9** | **9.4** | **1.4 H** | **22** | **10** | **10** | **9.4** | **8.7** | **5.7** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <340 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <17 U | <4.1 U | <4.0 U | <3.4 U | <3.5 U | <1 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <340 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <17 U | <4.1 U | <4.0 U | <3.4 U | <3.5 U | <1 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <340 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <17 U | <4.1 U | <4.0 U | <3.4 U | <3.5 U | <1 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-D-06 | VRTB-D-06 | VRTB-D-06 | VRTB-D-B1 | VRTB-D-B1 | VRTB-D-B1 | VRTB-D-B1 | VRTB-D-B1 | VRTB-D-B1 | VRTB-D-B1 | VRTB-D-B1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep |
| Sample Date | | 1/23/2024 | 4/3/2024 | 7/15/2024 | 12/14/2021 | 4/14/2022 | 6/14/2022 | 8/24/2022 | 10/26/2023 | 1/24/2024 | 4/2/2024 | 7/16/2024 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | <8.2 U | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <20 U | <3.7 U | <3.6 U | -- | -- | -- | -- | <4 U | <3.8 US | <3.7 U | <3.6 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <20 U | <3.7 U | <3.6 U | -- | <8.2 U | -- | -- | <4 U | <3.8 US | <3.7 U | <3.6 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <130 U | <23 U | <22 U | -- | -- | -- | -- | <25 U | <24 US | <23 U | <22 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <25 U | <4.6 U | <4.5 U | -- | -- | -- | -- | <5 U | <4.7 US | <4.6 U | <4.5 U |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <130 U | <23 U | <22 U | -- | -- | -- | -- | <25 U | <24 USM-03 | <23 U | <22 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <20 U | <3.7 U | <3.6 U | -- | -- | -- | -- | <4 U | <3.8 US | <3.7 U | <3.6 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <20 U | <3.7 U | <3.6 U | <7.7 U | <8.2 U | <8.2 U | <6.9 U | <4 U | <3.8 US | <3.7 U | <3.6 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <25 U | <4.6 U | <4.5 U | **2.5 J** | **3.5 J** | **4.1 J** | **6.3 J** | **14** | **59 S** | **24 M-03** | **8.9 M-03** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <20 U | <3.7 U | <3.6 U | **3.0 J** | **2.5 J** | **3.0 J** | **5.1 J** | **3.1 JM-03** | **2.2 JSM-03** | **3.4 JM-03** | **3.4 JM-03** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <20 U | <3.7 U | <3.6 U | -- | -- | -- | -- | <4 U | <3.8 US | <3.7 U | <3.6 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <5 U | <0.91 U | <0.90 U | -- | <8.2 U | -- | -- | <1 U | <0.95 U | <0.93 U | <0.90 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <50 U | <9.1 U | <9.0 U | -- | -- | -- | -- | <10 U | <9.5 UQS | <9.3 U | <9.0 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <5 U | <0.91 U | <0.90 U | <7.7 U | <8.2 U | <8.2 U | <6.9 U | <1 U | <0.95 U | <0.93 U | <0.90 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <5 U | <0.91 U | <0.90 U | <15 U | <16 U | <16 U | <14 U | <1 U | <0.95 U | <0.93 U | <0.90 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <50 U | <9.1 U | <9.0 U | -- | -- | -- | -- | <10 U | <50 UH | <9.3 U | <9.0 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <5 U | <0.91 U | <0.90 U | <7.7 U | <8.2 U | <8.2 U | <6.9 U | <1 U | <0.95 U | <0.93 U | <0.90 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <10 U | <1.8 U | <1.8 U | -- | -- | -- | -- | <2 U | <1.9 US | <1.9 U | <1.8 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <10 U | <1.8 U | <1.8 U | -- | -- | -- | -- | <2 U | <1.9 US | <1.9 U | <1.8 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <10 U | <1.8 U | <1.8 U | -- | -- | -- | -- | <2 U | <1.9 US | <1.9 U | <1.8 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <10 U | <1.8 U | <1.8 U | -- | -- | -- | -- | <2 U | <1.9 US | <1.9 U | <1.8 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **3.1 JM-03** | **2.4 M-03** | **2.3 M-03** | **13** | **16** | **14** | **9.8** | **11** | **11** | **13** | **13 M-03** |
| Perfluorobutanoic acid (PFBA) | ng/l | **8.2 J** | **8.1 M-03** | **8.2 M-03** | **13** | **18** | **24 B** | **17** | **21** | **25 S** | **20 M-03** | **17 M-03** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <5 U | <0.91 U | <0.90 U | <3.9 U | <4.1 U | <4.1 U | <3.5 U | <1 U | <0.95 U | <0.93 U | <0.90 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <5 U | <0.91 U | <0.90 U | <3.9 U | <4.1 U | <4.1 U | <3.5 U | <1 U | <0.95 U | <0.93 U | <0.90 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <5 U | <0.91 U | <0.90 U | -- | -- | -- | -- | <1 U | <0.95 U | <0.93 U | <0.90 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <5 U | <0.91 U | <0.90 U | <3.9 U | <4.1 U | <4.1 U | <3.5 U | <1 U | <0.95 U | <0.93 U | <0.90 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **7.8 M-03** | **7.0 M-03** | **6.6 M-03** | **9.7** | **12** | **17** | **12** | **29** | **42 S** | **41** | **34** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **6.7 M-03** | **7.9** | **7.8** | **12** | **14** | **18** | **24** | **39** | **100** | **56 M-03** | **28** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **120 M-03** | **110 M-03** | **88** | **160** | **260** | **350** | **290** | **480 M-03** | **780** | **830** | **460** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **11 M-03** | **14 M-03** | **13** | **21** | **31** | **43** | **36** | **54** | **81** | **49** | **37** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <5 U | <0.91 U | <0.90 U | <3.9 U | <4.1 U | <4.1 U | <3.5 U | <1 U | <0.95 US | <0.93 U | <0.90 U |
| Perfluorononanoic acid (PFNA) | ng/l | **1.4 JM-03** | **1.5 M-03** | **1.3 M-03** | **3.1 J** | **4.9** | **6.6** | **6.5** | **12 M-03** | **15 M-03** | **20 M-03** | **16 M-03** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <5 U | <0.91 UM-03 | <0.90 U | <3.9 U | <4.1 U | <4.1 U | <3.5 U | **0.26 JM-03** | <0.95 U | <0.93 U | **0.27 J** |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **310 M-03** | **300 M-03** | **260 M-03** | **700** | **1100** | **1600** | **1500 H** | **1800 M-03** | **2400 B** | **2300 HM-03** | **2200 BM-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **10 M-03** | **9.6 M-03** | **9.7 M-03** | **22** | **30** | **40** | **35** | **58 M-03** | **120** | **110 M-03** | **56 M-03** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **5.7** | **4.7** | **4.6** | **14** | **19** | **19** | **14** | **23** | **38** | **29** | **25 M-03** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **7 J** | **9.6** | **12 M-03** | **17** | **24** | **36 H** | **26** | **40** | **62 S** | **39** | **29 M-03** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <5 U | <0.91 U | <0.90 U | <3.9 U | <4.1 U | <4.1 UQ | <3.5 U | <1 U | <5 UH | <0.93 U | <0.90 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <5 U | <0.91 U | <0.90 U | <3.9 U | <4.1 U | <4.1 U | <3.5 U | <1 U | <0.95 U | <0.93 U | <0.90 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <5 U | <0.91 U | <0.90 U | <3.9 U | <4.1 U | <4.1 U | <3.5 U | <1 U | <0.95 U | <0.93 U | <0.90 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| | Location | VRTB-D-G4 | VRTB-D-G4 | VRTB-D-G4 | VRTB-D-G4 | VRTB-D-G4 | VRTB-D-G4 | VRTB-D-G4 | VRTB-D-G4 | VRTB-D-M5 | VRTB-D-M5 | VRTB-D-M5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth Interval (ft bgs) | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep |
| | Sample Date | 12/15/2021 | 4/14/2022 | 6/14/2022 | 8/24/2022 | 10/26/2023 | 1/24/2024 | 4/2/2024 | 7/16/2024 | 12/21/2021 | 4/13/2022 | 6/13/2022 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | <8.1 U | -- | -- | -- | -- | -- | -- | -- | <8.0 U | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | -- | -- | -- | -- | <4 U | <3.9 UQ | <3.5 U | <3.6 U | -- | -- | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | -- | <8.1 U | -- | -- | <4 U | <3.9 UQ | <3.5 U | <3.6 U | -- | <8.0 U | -- |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | -- | -- | -- | -- | <25 U | <24 UQ | <22 U | <22 U | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | -- | -- | -- | -- | <4.9 U | <4.8 UQ | <4.4 U | <4.4 U | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | -- | -- | -- | -- | <25 U | <24 UQ | <22 U | <22 U | -- | -- | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | -- | -- | -- | -- | <4 U | <3.9 UQ | <3.5 U | <3.6 U | -- | -- | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <7.8 U | <8.1 U | <7.2 U | <6.9 U | <4 U | <3.9 UQ | <3.5 U | <3.6 U | <7.9 U | <8.0 U | <6.9 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <7.8 U | <8.1 U | <7.2 U | <6.9 U | <4.9 U | <4.8 UQ | <4.4 U | <4.4 U | <7.9 U | <8.0 U | <6.9 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <7.8 U | <8.1 U | <7.2 U | <6.9 U | <4 U | <3.9 UQ | <3.5 U | <3.6 U | <7.9 U | <8.0 U | <6.9 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | -- | -- | -- | -- | <4 U | <3.9 UQ | <3.5 U | <3.6 U | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | <8.1 U | -- | -- | <0.99 U | <0.96 U | <0.89 U | <0.89 U | -- | <8.0 U | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | -- | -- | <10 UH | <9.6 UQ | <8.9 U | <8.9 U | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <7.8 U | <8.1 U | <7.2 U | <6.9 U | <0.99 U | <0.96 U | <0.89 U | <0.89 U | <7.9 U | <8.0 U | <6.9 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <16 U | <16 U | <14 U | <14 U | <0.99 U | <0.96 U | <0.89 U | <0.89 U | <16 U | <16 U | <14 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | -- | -- | <9.9 U | <9.6 UQ | <8.9 U | <8.9 U | -- | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <7.8 U | <8.1 U | <7.2 U | <6.9 U | <0.99 U | <0.96 U | <0.89 U | <0.89 U | <7.9 U | <8.0 U | <6.9 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | -- | -- | <2 U | <1.9 UQ | <1.8 U | <1.8 U | -- | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | -- | -- | <2 U | <1.9 UQ | <1.8 U | <1.8 U | -- | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | -- | -- | <2 U | <1.9 UQ | <1.8 U | <1.8 U | -- | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | -- | -- | <2 U | <1.9 UQ | <1.8 U | <1.8 U | -- | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | <3.9 U | **1.1 J** | **1.7 J** | **0.95 J** | **0.92 J** | **0.43 JQ** | **1.1 M-03** | **0.89 M-03** | **2.9 J** | **3.8 J** | **3.5** |
| Perfluorobutanoic acid (PFBA) | ng/l | **6.9** | **7.3** | **9.2 B** | **5.8** | **5.5** | **6** | **5.8 M-03** | **7.1 M-03** | **5.8** | **5.9** | **6.7** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <3.9 U | <4.1 U | <3.6 U | <3.4 U | <0.99 U | <0.96 UQ | <0.89 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <3.9 U | <4.1 U | <3.6 U | <3.4 U | <0.99 U | <0.96 UQ | <0.89 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | -- | -- | <0.99 U | <0.96 UQ | <0.89 U | <0.89 U | -- | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <3.9 U | <4.1 U | <3.6 U | <3.4 U | <0.99 U | <0.96 U | <0.89 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | <3.9 U | **1.5 J** | **1.8 J** | **1.3 J** | **1.7** | **1.5 M-03** | **1.7 M-03** | **1.6 M-03** | **4.8** | **4.0** | **3.1 J** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **3.8 J** | **4.5** | **4.8** | **3.5** | **3.1** | **4.6** | **3.7 M-03** | **3.8** | **5.6** | **4.9** | **4.4** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **45** | **37** | **50** | **39** | **34** | **49 M-03** | **46 M-03** | **38 M-03** | **80** | **68** | **67** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **13** | **13** | **16** | **12** | **8.3** | **16** | **8.1** | **10** | **12** | **12** | **9.3** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <3.9 U | <4.1 U | <3.6 U | <3.4 U | <0.99 U | <0.96 UQ | <0.89 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U |
| Perfluorononanoic acid (PFNA) | ng/l | <3.9 U | <4.1 U | <3.6 U | <3.4 U | **0.45 JM-03** | **0.26 JQM-03** | **0.61 JM-03** | **0.48 JM-03** | **1.1 J** | <4.0 U | <3.4 U |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <3.9 U | <4.1 U | **1.2 J** | <3.4 U | <0.99 U | <0.96 UQ | <0.89 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **110** | **100** | **99** | **84** | **110 M-03** | **130 M-03** | **120 HM-03** | **120 BM-03** | **170** | **310** | **260** |
| Perfluorooctanoic acid (PFOA) | ng/l | **4.7** | **3.7 J** | **3.8** | **3.4** | **3.2 M-03** | **4.4 M-03** | **3.9** | **3.7 M-03** | **7.2** | **5.0** | **4.0** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **1.4 J** | **1.2 J** | **2.6 J** | **1.4 J** | **2 M-03** | **2 M-03** | **1.4** | **1.5 M-03** | **4.1** | **2.9 J** | **3.9** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **20** | **20** | **22 H** | **14** | **12** | **19** | **8.6 M-03** | **12** | **13** | **12** | **13** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <3.9 U | <4.1 U | <3.4 UH | <3.4 U | <0.99 U | <0.97 U | <0.89 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <3.9 U | <4.1 U | <3.6 U | <3.4 U | <0.99 U | <0.96 U | <0.89 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <3.9 U | <4.1 U | <3.6 U | <3.4 U | <0.99 U | <0.96 U | <0.89 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-D-M5 | VRTB-D-M5 | VRTB-D-M5 | VRTB-D-M5 | VRTB-D-M5 | VRTB-D-P8 | VRTB-D-P8 | VRTB-D-P8 | VRTB-D-P8 | VRTB-D-P8 | VRTB-D-P8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep |
| Sample Date | | 8/22/2022 | 10/25/2023 | 1/23/2024 | 4/3/2024 | 7/15/2024 | 12/21/2021 | 4/13/2022 | 6/13/2022 | 6/13/2022 | 8/22/2022 | 8/22/2022 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | <7.9 U | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | -- | <3.9 U | <20 U | <3.7 U | <3.7 U | -- | -- | -- | -- | -- | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | -- | <3.9 U | <20 U | <3.7 U | <3.7 U | -- | <7.9 U | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | -- | <24 U | <130 U | <23 U | <23 U | -- | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | -- | <4.8 U | <25 U | <4.6 U | <4.7 U | -- | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | -- | <24 U | <130 U | <23 U | <23 U | -- | -- | -- | -- | -- | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | -- | <3.9 U | <20 U | <3.7 U | <3.7 U | -- | -- | -- | -- | -- | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <7.0 U | <3.9 U | <20 U | <3.7 U | <3.7 U | <9.8 U | <7.9 U | <6.8 U | <6.9 U | <9.6 U | <7.4 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <7.0 U | <4.8 U | <25 U | <4.6 U | <4.7 U | <9.8 U | <7.9 U | <6.8 U | <6.9 U | <9.6 U | <7.4 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <7.0 U | <3.9 U | <20 U | <3.7 U | <3.7 U | <9.8 U | <7.9 U | <6.8 U | <6.9 U | <9.6 U | <7.4 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | -- | <3.9 U | <20 U | <3.7 U | <3.7 U | -- | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | <0.97 U | <5 U | <0.93 U | <0.93 U | -- | <7.9 U | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | <9.7 U | <50 U | <9.3 U | <9.3 U | -- | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <7.0 U | <0.97 U | <5 U | <0.93 U | <0.93 U | <9.8 U | <7.9 U | <6.8 U | <6.9 U | <9.6 U | <7.4 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <14 U | <0.97 U | <5 U | <0.93 U | <0.93 U | <20 U | <16 U | <14 U | <14 U | <19 U | <15 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | <9.7 U | <50 U | <9.3 U | <9.3 U | -- | -- | -- | -- | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <7.0 U | <0.97 U | <5 U | <0.93 U | <0.93 U | <9.8 U | <7.9 U | <6.8 U | <6.9 U | <9.6 U | <7.4 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | <1.9 U | <10 U | <1.9 U | <1.9 U | -- | -- | -- | -- | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | <1.9 U | <10 U | <1.9 U | <1.9 U | -- | -- | -- | -- | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | <1.9 U | <10 U | <1.9 U | <1.9 U | -- | -- | -- | -- | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | <1.9 U | <10 U | <1.9 U | <1.9 U | -- | -- | -- | -- | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **4.8** | **3.3** | **3.3 JM-03** | **3.2 M-03** | **2.4 M-03** | **4.8 J** | **4.8** | **4.2** | **4.0** | **7.6** | **6.2** |
| Perfluorobutanoic acid (PFBA) | ng/l | **6.4** | **6.1** | **7.7 J** | **7.7 M-03** | **8.7 M-03** | **16 Q** | **11** | **13** | **13** | **16** | **13** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <3.5 U | <0.97 U | <5 U | <0.93 U | <0.93 U | <4.9 U | <4.0 U | <3.4 U | <3.5 U | <4.8 U | <3.7 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <3.5 U | <0.97 U | <5 U | <0.93 U | <0.93 U | <4.9 U | <4.0 U | <3.4 U | <3.5 U | <4.8 U | <3.7 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | <0.97 U | <5 U | <0.93 U | <0.93 U | -- | -- | -- | -- | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <3.5 U | <0.97 U | <5 U | <0.93 U | <0.93 U | <4.9 U | <4.0 U | <3.4 U | <3.5 U | <4.8 U | <3.7 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **2.6 J** | **3.8** | **3.8 J** | **4.6 M-03** | **3.5** | **3.4 J** | **3.1 J** | **2.4 J** | **2.4 J** | **3.5 J** | **2.6 J** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **4.7** | **6.2** | **6.6 M-03** | **7.2** | **5.8** | **26** | **21** | **24** | **24** | **32** | **23** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **83** | **65 M-03** | **87 M-03** | **82 M-03** | **61** | **93** | **78** | **78** | **75** | **110** | **83** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **14** | **9** | **11** | **13 M-03** | **12** | **25** | **21** | **22** | **21** | **27** | **21** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <3.5 U | <0.97 U | <5 U | <0.93 U | <0.93 U | <4.9 U | <4.0 U | <3.4 U | <3.5 U | <4.8 U | <3.7 U |
| Perfluorononanoic acid (PFNA) | ng/l | <3.5 U | **0.77 JM-03** | **1.3 JM-03** | **1.3 M-03** | **1.1 M-03** | **6.3** | **4.5** | **4.4** | **4.2** | **5.5** | **4.3** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <3.5 U | <0.97 U | <5 U | <0.93 U | <0.93 U | <4.9 U | <4.0 U | <3.4 U | <3.5 U | <4.8 U | <3.7 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **230** | **260 M-03** | **290 M-03** | **280 M-03** | **230 M-03** | **210** | **190** | **160** | **150** | **220** | **180** |
| Perfluorooctanoic acid (PFOA) | ng/l | **4.0** | **6.8 M-03** | **8.5 M-03** | **9.2 M-03** | **6.6 M-03** | **20** | **18** | **18** | **18** | **25** | **19** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **5.7** | **3.4** | **4.5 J** | **3.8 M-03** | **2.9** | **3.3 J** | **3.1 J** | **2.5 J** | **2.5 J** | **3.2 J** | **2.5 J** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **15** | **8.8** | <10 U | **11** | **13** | **27** | **26** | **26** | **25** | **32** | **25** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <3.5 U | <0.97 U | <5 U | <0.93 U | <0.93 U | <4.9 U | <4.0 U | <3.4 U | <3.5 U | <4.8 U | <3.7 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <3.5 U | <0.97 U | <5 U | <0.93 U | <0.93 U | <4.9 U | <4.0 U | <3.4 U | <3.5 U | <4.8 U | <3.7 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <3.5 U | <0.97 U | <5 U | <0.93 U | <0.93 U | <4.9 U | <4.0 U | <3.4 U | <3.5 U | <4.8 U | <3.7 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-D-P8 | VRTB-D-P8 | VRTB-D-P8 | VRTB-D-P8 | VRTB-D-R7 | VRTB-D-R7 | VRTB-D-R7 | VRTB-D-R7 | VRTB-D-R7 | VRTB-D-R7 | VRTB-D-R7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep |
| Sample Date | | 10/25/2023 | 1/23/2024 | 4/3/2024 | 7/15/2024 | 12/21/2021 | 4/13/2022 | 6/13/2022 | 8/22/2022 | 10/25/2023 | 1/23/2024 | 4/3/2024 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | <8.1 U | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <3.8 U | <20 U | <3.7 U | <3.6 U | -- | -- | -- | -- | <3.9 U | <20 U | <4.2 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <3.8 U | <20 U | <3.7 U | <3.6 U | -- | <8.1 U | -- | -- | <3.9 U | <20 U | <4.2 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <24 U | <130 U | <23 U | <22 U | -- | -- | -- | -- | <25 U | <130 U | <26 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <4.8 U | <25 U | <4.6 U | <4.5 U | -- | -- | -- | -- | <4.9 U | <25 U | <5.2 U |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <24 U | <130 U | <23 U | <22 U | -- | -- | -- | -- | <25 U | <130 U | <26 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <3.8 U | <20 U | <3.7 U | <3.6 U | -- | -- | -- | -- | <3.9 U | <20 U | <4.2 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <3.8 U | <20 U | <3.7 U | <3.6 U | <7.8 U | <8.1 U | <6.9 U | <7.0 U | <3.9 U | <20 U | <4.2 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <4.8 U | <25 U | <4.6 U | <4.5 U | <7.8 U | <8.1 U | <6.9 U | <7.0 U | <4.9 U | <25 U | <5.2 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <3.8 U | <20 U | <3.7 U | <3.6 U | <7.8 U | <8.1 U | <6.9 U | <7.0 U | <3.9 U | <20 U | <4.2 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <3.8 U | <20 U | <3.7 U | <3.6 U | -- | -- | -- | -- | <3.9 U | <20 U | <4.2 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | -- | <8.1 U | -- | -- | <0.99 U | <5 U | <1.0 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <9.5 U | <50 U | <9.2 U | <8.9 U | -- | -- | -- | -- | <10 UH | <50 U | <10 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | <7.8 U | <8.1 U | <6.9 U | <7.0 U | <0.99 U | <5 U | <1.0 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | <16 U | <16 U | <14 U | <14 U | <0.99 U | <5 U | <1.0 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <9.5 U | <50 U | <9.2 U | <8.9 U | -- | -- | -- | -- | <9.9 U | <50 U | <10 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | <7.8 U | <8.1 U | <6.9 U | <7.0 U | <0.99 U | <5 U | <1.0 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <1.9 U | <10 U | <1.8 U | <1.8 U | -- | -- | -- | -- | <2 U | <10 U | <2.1 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <1.9 U | <10 U | <1.8 U | <1.8 U | -- | -- | -- | -- | <2 U | <10 U | <2.1 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <1.9 U | <10 U | <1.8 UM-03 | <1.8 U | -- | -- | -- | -- | <2 U | <10 U | <2.1 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <1.9 U | <10 U | <1.8 U | <1.8 U | -- | -- | -- | -- | <2 U | <10 U | <2.1 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **9.5** | **9.5 M-03** | **9.5** | **5.9 M-03** | **1.2 J** | **2.4 J** | **2.2 J** | **2.7 J** | **5.8** | **6.6** | **8.5** |
| Perfluorobutanoic acid (PFBA) | ng/l | **15** | **18 JQ** | **14 M-03** | **12** | **5.5** | **10** | **11** | **8.6** | **10** | **10 J** | **11** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <0.99 U | <5 U | <1.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <0.99 U | <5 U | <1.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | -- | -- | -- | -- | <0.99 U | <5 U | <1.0 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <0.99 U | <5 U | <1.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **2.9** | **2.2 JM-03** | **3.3 M-03** | **4.1** | **1.6 J** | **2.0 J** | **1.1 J** | **1.0 J** | **1.9 M-03** | **1.3 JM-03** | **2.3 M-03** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **25** | **27 M-03** | **30** | **22** | **9.6** | **20** | **12** | **9.9** | **15** | **16 M-03** | **23** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **86 M-03** | **150 M-03** | **160** | **120** | **41** | **48** | **49** | **46** | **56 M-03** | **72 M-03** | **85 M-03** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **26** | **28** | **29** | **20** | **10** | **15** | **12** | **12** | **13** | **17** | **20 M-03** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <0.99 U | <5 U | <1.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | **5.8** | **6.8 M-03** | **7.5 M-03** | **6.7** | **2.4 J** | **1.8 J** | **1.1 J** | **0.95 J** | **1 M-03** | **1.5 J** | **1.7 M-03** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <0.95 U | <5 U | <0.92 U | <0.88 UH | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <0.99 U | <5 U | <1.0 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **210 M-03** | **280 M-03** | **270 M-03** | **310 M-03** | **120** | **120** | **92** | **81** | **92 M-03** | **98 M-03** | **97 M-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **19 M-03** | **22** | **25 M-03** | **22 M-03** | **8.6** | **10** | **6.4** | **5.5** | **11 M-03** | **10 M-03** | **16 M-03** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **3.6** | **4.6 JM-03** | **6.6** | **3.7** | **2.0 J** | **1.5 J** | **1.6 J** | **1.5 J** | **2** | **1.9 J** | **2.2** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **27** | **28** | **28** | **23 M-03** | **11** | **20** | **19** | **17** | **16** | **17** | **21 M-03** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <0.99 U | <5 U | <1.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <0.99 U | <5 U | <1.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <0.95 U | <5 U | <0.92 U | <0.89 U | <3.9 U | <4.0 U | <3.4 U | <3.5 U | <0.99 U | <5 U | <1.0 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-D-R7 | VRTB-D-S2 | VRTB-D-S2 | VRTB-D-S2 | VRTB-D-S2 | VRTB-D-S2 | VRTB-D-S2 | VRTB-D-S2 | VRTB-D-S2 | VRTB-D-S2 | VRTB-D-Y3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Deep |
| Sample Date | | 7/15/2024 | 12/15/2021 | 4/14/2022 | 6/14/2022 | 8/24/2022 | 8/24/2022 | 10/26/2023 | 1/24/2024 | 4/2/2024 | 7/16/2024 | 12/15/2021 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | <7.6 U | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <3.6 U | -- | -- | -- | -- | -- | <4 U | <3.9 U | <3.6 U | <3.6 U | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <3.6 U | -- | <7.6 U | -- | -- | -- | <4 U | <3.9 U | <3.6 U | <3.6 U | -- |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <22 U | -- | -- | -- | -- | -- | <25 U | <24 U | <22 U | <22 U | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <4.4 U | -- | -- | -- | -- | -- | <5 U | <4.9 U | <4.5 U | <4.4 U | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <22 U | -- | -- | -- | -- | -- | <25 U | <24 U | <22 U | <22 U | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <3.6 U | -- | -- | -- | -- | -- | <4 U | <3.9 U | <3.6 U | <3.6 U | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <3.6 U | <8.1 U | <7.6 U | <8.8 U | <7.1 U | <6.9 HU | <4 U | <3.9 U | <3.6 U | <3.6 U | <7.8 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <4.4 U | <8.1 U | <7.6 U | <8.8 U | <7.1 U | <6.9 HU | <5 U | <4.9 U | <4.5 U | <4.4 U | <7.8 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <3.6 U | <8.1 U | <7.6 U | <8.8 U | <7.1 U | <6.9 HU | <4 U | <3.9 U | <3.6 U | <3.6 U | <7.8 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <3.6 U | -- | -- | -- | -- | -- | <4 U | <3.9 U | <3.6 U | <3.6 U | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <0.89 U | -- | <7.6 U | -- | -- | -- | <0.99 U | <0.97 U | <0.90 U | <0.89 U | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <8.9 UH | -- | -- | -- | -- | -- | <9.9 U | <9.7 UQ | <9.0 U | <8.9 U | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <0.89 U | <8.1 U | <7.6 U | <8.8 U | <7.1 U | <6.9 HU | <0.99 U | <0.97 U | <0.90 U | <0.89 U | <7.8 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <0.89 U | <16 U | <15 U | <14 UH | <14 U | <14 HU | <0.99 U | <0.97 U | <0.90 U | <0.89 U | <16 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <8.9 U | -- | -- | -- | -- | -- | <9.9 U | <9.7 UQ | <9.0 U | <8.9 U | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <0.89 U | <8.1 U | <7.6 U | <8.8 U | <7.1 U | <6.9 HU | <0.99 U | <0.97 U | <0.90 U | <0.89 U | <7.8 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <1.8 U | -- | -- | -- | -- | -- | <2 U | <1.9 U | <1.8 U | <1.8 U | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <1.8 U | -- | -- | -- | -- | -- | <2 U | <1.9 U | <1.8 U | <1.8 U | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <1.8 U | -- | -- | -- | -- | -- | <2 U | <1.9 U | <1.8 U | <1.8 U | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <1.8 U | -- | -- | -- | -- | -- | <2 U | <1.9 U | <1.8 U | <1.8 U | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **5.2 M-03** | **9.0** | **12** | **19** | **18** | **20 H** | **17** | **16** | **18 M-03** | **14** | **3.1 J** |
| Perfluorobutanoic acid (PFBA) | ng/l | **12 M-03** | **6.0** | **7.1** | **9.8 B** | **6.7** | **5.8 H** | **6.2** | **6.8 M-03** | **5.8 M-03** | **5.4 M-03** | **4.1** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <0.89 U | <4.0 U | <3.8 U | <4.4 U | <3.6 U | <3.4 HU | <0.99 U | <0.97 U | <0.90 U | <0.89 U | <3.9 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <0.89 U | <4.0 U | <3.8 U | <4.4 U | <3.6 U | <3.4 HU | <0.99 U | <0.97 U | <0.90 U | <0.89 U | <3.9 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <0.89 U | -- | -- | -- | -- | -- | <0.99 U | <0.97 U | <0.90 U | <0.89 U | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <0.89 U | <4.0 U | <3.8 U | <4.4 U | <3.6 U | <3.4 HU | <0.99 U | <0.97 U | <0.90 U | <0.89 U | <3.9 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **1.7** | **5.1** | **6.1** | **7.6** | **5.9** | **5.2 H** | **8.3** | **8.4** | **8.3 M-03** | **6.8 M-03** | **2.1 J** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **18** | **6.6** | **6.6** | **9.1** | **5.5** | **5.7 H** | **7** | **6.9** | **7.1 M-03** | **6.3** | **3.7 J** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **61** | **130** | **150** | **200** | **160** | **150 H** | **170 M-03** | **170** | **170** | **160** | **57** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **18** | **13** | **17** | **19** | **14** | **14 H** | **13** | **12** | **12 M-03** | **11 M-03** | **5.8** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <0.89 U | <4.0 U | <3.8 U | <4.4 U | <3.6 U | <3.4 HU | <0.99 U | <0.97 U | <0.90 U | <0.89 U | <3.9 U |
| Perfluorononanoic acid (PFNA) | ng/l | **1.2 M-03** | **1.3 J** | **1.1 J** | **2.2 J** | **1.5 J** | **1.5 HJ** | **0.75 JM-03** | **0.77 JM-03** | **0.73 JM-03** | **0.58 JM-03** | <3.9 U |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <0.89 U | <4.0 U | <3.8 U | <4.4 U | <3.6 U | <3.4 HU | <0.99 U | <0.97 U | <0.90 UM-03 | <0.89 U | <3.9 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **100 M-03** | **170** | **220** | **350** | **300** | **330 H** | **290 M-03** | **250 B** | **240 HM-03** | **210 BM-03** | **100** |
| Perfluorooctanoic acid (PFOA) | ng/l | **13 M-03** | **25** | **19** | **23** | **14** | **16 H** | **14 M-03** | **14** | **16 M-03** | **14 M-03** | **8.4** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **1.9** | **13** | **19** | **33** | **32** | **35 H** | **37** | **40** | **37** | **33** | **5.7** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **20** | **8.8** | **9.7** | **16 H** | **9.9** | **10 H** | **8.5** | **7.7** | **9.0 M-03** | **7.6 M-03** | **3.8 J** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <0.89 U | <4.0 U | <3.8 U | <4.4 UQ | <3.6 U | <3.4 HU | <0.99 U | <0.97 U | <0.90 U | <0.89 U | <3.9 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <0.89 U | <4.0 U | <3.8 U | <4.4 U | <3.6 U | <3.4 HU | <0.99 U | <0.97 U | <0.90 U | <0.89 U | <3.9 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <0.89 U | <4.0 U | <3.8 U | <4.4 U | <3.6 U | <3.4 HU | <0.99 U | <0.97 U | <0.90 U | <0.89 U | <3.9 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-D-Y3 | VRTB-D-Y3 | VRTB-D-Y3 | VRTB-D-Y3 | VRTB-D-Y3 | VRTB-D-Y3 | VRTB-D-Y3 | VRTB-L-06 | VRTB-L-06 | VRTB-L-06 | VRTB-L-06 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Deep | Deep | Deep | Deep | Deep | Deep | Deep | Longsect | Longsect | Longsect | Longsect |
| Sample Date | | 4/14/2022 | 6/14/2022 | 8/24/2022 | 10/26/2023 | 1/24/2024 | 4/2/2024 | 7/16/2024 | 12/23/2021 | 4/14/2022 | 6/14/2022 | 10/24/2023 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | <8.2 U | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | -- | -- | -- | <4 U | <3.9 U | <3.7 U | <3.6 U | -- | -- | -- | <4.1 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <8.2 U | -- | -- | <4 U | <3.9 U | <3.7 U | <3.6 U | -- | -- | -- | <4.1 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | -- | -- | -- | <25 U | <24 U | <23 U | <22 U | -- | -- | -- | <25 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | -- | -- | -- | <5 U | <4.9 U | <4.7 U | <4.4 U | -- | -- | -- | <5.1 U |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | -- | -- | -- | <25 U | <24 U | <23 U | <22 U | -- | -- | -- | <25 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | -- | -- | -- | <4 U | <3.9 U | <3.7 U | <3.6 U | -- | -- | -- | <4.1 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <8.2 U | <6.8 U | <6.8 U | <4 U | <3.9 U | <3.7 U | <3.6 U | <200 U | <6.9 U | <6.8 U | <4.1 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <8.2 U | <6.8 U | <6.8 U | <5 U | <4.9 U | <4.7 U | <4.4 U | **110 J** | **110** | **75** | **140** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <8.2 U | <6.8 UQ | <6.8 U | <4 U | <3.9 U | <3.7 U | <3.6 U | <200 U | **30** | **35** | **70** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | -- | -- | -- | <4 U | <3.9 U | <3.7 U | <3.6 U | -- | -- | -- | <4.1 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <8.2 U | -- | -- | <1 U | <0.97 U | <0.93 U | <0.89 U | -- | -- | -- | <1 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | -- | <9.5 UH | <9.4 U | <9.3 U | <8.9 U | -- | -- | -- | <10 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <8.2 U | <6.8 UQ | <6.8 U | <1 U | <0.97 U | <0.93 U | <0.89 U | <200 U | <6.9 U | <6.8 U | <1 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <16 U | <14 UQ | <14 U | <1 U | <0.97 U | <0.93 U | <0.89 U | <400 U | <14 U | <14 U | <1 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | -- | <10 U | <9.7 U | <9.3 U | <8.9 U | -- | -- | -- | <10 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <8.2 U | <6.8 UQ | <6.8 U | <1 U | <0.97 U | <0.93 U | <0.89 U | <200 U | <6.9 U | <6.8 U | <1 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | -- | <2 U | <1.9 U | <1.9 U | <1.8 UM-03 | -- | -- | -- | <2 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | -- | <2 U | <1.9 U | <1.9 U | <1.8 U | -- | -- | -- | <2 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | -- | <2 U | <1.9 U | <1.9 U | <1.8 U | -- | -- | -- | <2 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | -- | <2 U | <1.9 U | <1.9 U | <1.8 U | -- | -- | -- | <2 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **3.4 J** | **3.4** | **4.1** | **2.7** | **1.6** | **2.8 M-03** | **3.2 M-03** | <100 U | **13** | **8.2** | **15** |
| Perfluorobutanoic acid (PFBA) | ng/l | **4.7** | **5.1 B** | **3.7** | **3.1 JM-03** | **2.5 JM-03** | **4.7 M-03** | **3.7 M-03** | <100 U | **59** | **51 B** | **80 M-03** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <4.1 U | <3.4 UQ | <3.4 U | <1 U | <0.97 U | <0.93 U | <0.89 U | <100 U | <3.4 U | <3.4 UQ | <1 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <4.1 U | <3.5 U | <3.4 U | <1 U | <0.97 U | <0.93 U | <0.89 U | <100 U | <3.4 U | <3.4 U | **0.7 JM-03** |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | -- | <1 U | <0.97 U | <0.93 U | <0.89 U | -- | -- | -- | <1 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <4.1 U | <3.4 UQ | <3.4 U | <1 U | <0.97 U | <0.93 U | <0.89 U | <100 U | <3.4 U | <3.4 U | <1 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **2.2 J** | **1.9 JQ** | **1.5 J** | **2.3** | **1.4 M-03** | **1.9 M-03** | **1.8 M-03** | **61 J** | **69** | **45** | **180** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **2.6 J** | **3.2 J** | **2.6 J** | **2.3** | **1.8** | **3.0 M-03** | **3.3** | **130** | **170** | **170** | **180** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **66** | **70 Q** | **63** | **51** | **35** | **59** | **61** | **1100** | **1100** | **490 J** | **1700 M-03** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **4.1** | **4.4** | **4.4** | **3.6** | **2.7** | **5.0 M-03** | **5.5 M-03** | **110** | **210** | **95** | **220** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <4.1 U | <3.4 UQ | <3.4 U | <1 U | <0.97 U | <0.93 U | <0.89 U | <100 U | <3.4 U | <3.4 UQ | <1 U |
| Perfluorononanoic acid (PFNA) | ng/l | <4.1 U | <3.5 U | <3.4 U | **0.53 JM-03** | **0.25 JM-03** | <0.93 U | **0.31 JM-03** | **63 J** | **75** | **69 Q** | **86 M-03** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <4.1 U | <3.4 U | <3.4 U | <1 U | <0.97 U | <0.93 U | <0.89 U | <100 U | <3.4 U | <3.4 U | **1.3 M-03** |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **120** | **170 Q** | **130** | **98 M-03** | **60 B** | **90 HM-03** | **89 BM-03** | **13000** | **13000** | **14000** | **17000 HM-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **6.1** | **5.8** | **5.0** | **4.3 M-03** | **2.8 M-03** | **5.2 M-03** | **4.8 M-03** | **200** | **250** | **210** | **220 M-03** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **7.0** | **5.6** | **7.4** | **7** | **4.1** | **7.1** | **7.3** | <100 U | **35** | **9.0** | **70 M-03** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **3.6 J** | **3.3 J** | **3.8** | **2.3 M-03** | **1.9** | **3.9 M-03** | **4.2 M-03** | **120** | **180** | **97** | **150** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <4.1 U | <3.4 UQ | <3.4 U | <1 U | <0.97 U | <0.93 U | <0.89 U | <100 U | <3.4 U | <3.4 U | <1 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <4.1 U | <3.4 UQ | <3.4 U | <1 U | <0.97 U | <0.93 U | <0.89 U | <100 U | <3.4 U | <3.4 U | <1 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <4.1 U | <3.5 U | <3.4 U | <1 U | <0.97 U | <0.93 U | <0.89 U | <100 U | <3.4 U | <3.4 U | <1 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-L-06 | VRTB-L-06 | VRTB-L-06 | VRTB-L-B1 | VRTB-L-B1 | VRTB-L-B1 | VRTB-L-B1 | VRTB-L-B1 | VRTB-L-B1 | VRTB-L-B1 | VRTB-L-BB8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect |
| Sample Date | | 1/24/2024 | 4/1/2024 | 7/17/2024 | 12/27/2021 | 4/14/2022 | 6/14/2022 | 10/26/2023 | 1/25/2024 | 4/4/2024 | 7/17/2024 | 12/27/2021 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <3.7 U | <3.9 U | -- | -- | -- | -- | <4 U | <3.7 U | <3.7 U | <3.5 U | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <3.7 U | <3.9 U | -- | -- | -- | -- | <4 U | <3.7 U | <3.7 U | <3.5 U | -- |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <23 U | <24 U | -- | -- | -- | -- | <25 U | <23 U | <23 U | <22 U | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <4.7 U | <4.8 U | -- | -- | -- | -- | **1.1 JM-03** | <4.6 U | <4.6 U | <4.4 U | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <23 U | <24 U | -- | -- | -- | -- | <25 U | <23 U | <23 U | <22 U | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <3.7 U | <3.9 U | -- | -- | -- | -- | <4 U | <3.7 U | <3.7 U | <3.5 U | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <3.7 U | <3.9 U | -- | <8.2 U | <9.3 U | <8.4 U | <4 U | <3.7 U | <3.7 U | <3.5 U | <80 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | **200** | **140 M-03** | -- | **2.5 J** | **4.9 J** | **2.6 J** | <5 U | <4.6 U | <4.6 UM-03 | **14 M-03** | **28 J** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **61** | **55** | -- | **6.6 J** | **5.2 J** | **3.8 J** | **1.9 J** | **0.93 J** | **0.94 JM-03** | **47** | <80 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <3.7 U | <3.9 U | -- | -- | -- | -- | <4 U | <3.7 U | <3.7 U | <3.5 U | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <0.94 U | <0.96 U | -- | -- | -- | -- | <1 U | <0.93 U | <0.93 U | <0.88 U | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <500 U | <1000 UH | -- | -- | -- | -- | <10 U | <9.3 UQ | <9.3 U | <8.8 U | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <0.94 U | <0.96 U | -- | <8.2 U | <9.3 U | <8.4 U | <1 U | <0.93 U | <0.93 U | <0.88 U | <80 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <0.94 U | <0.96 U | -- | <16 U | <19 U | <17 U | <1 U | <0.93 U | <0.93 U | <0.88 U | <160 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <500 U | <1000 UH | -- | -- | -- | -- | <10 U | <9.3 UQ | <9.3 U | <8.8 U | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <0.94 U | <0.96 U | -- | <8.2 U | <9.3 U | <8.4 U | <1 U | <0.93 U | <0.93 U | <0.88 U | <80 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <1.9 U | <1.9 U | -- | -- | -- | -- | <2 U | <1.9 U | <1.9 U | <1.8 U | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <1.9 U | <1.9 U | -- | -- | -- | -- | <2 U | <1.9 U | <1.9 U | <1.8 U | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <1.9 U | <1.9 U | -- | -- | -- | -- | <2 U | <1.9 U | <1.9 U | <1.8 U | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <1.9 U | <1.9 U | -- | -- | -- | -- | <2 U | <1.9 U | <1.9 U | <1.8 U | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **6.4** | **5.7 M-03** | -- | **5.3** | **11** | **10** | **5.7** | **5.8** | **6.0** | **5.1** | **11 J** |
| Perfluorobutanoic acid (PFBA) | ng/l | **50** | **46 M-03** | -- | **6.1** | **14** | **10** | **7** | **7.6** | **7.4 M-03** | **13 M-03** | **26 J** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <0.94 U | <0.96 U | -- | <4.1 U | <4.7 U | <4.2 U | <1 U | <0.93 U | <0.93 U | <0.88 U | <40 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <0.94 U | **0.42 JM-03** | -- | <4.1 U | <4.7 U | <4.2 U | <1 U | <0.93 U | <0.93 U | **0.39 JM-03** | <40 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <0.94 U | <0.96 U | -- | -- | -- | -- | <1 U | <0.93 U | <0.93 U | <0.88 U | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <0.94 U | <0.96 U | -- | <4.1 U | <4.7 U | <4.2 U | <1 U | <0.93 U | <0.93 U | <0.88 U | <40 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **230** | **99** | -- | **12** | **18** | **15** | **12 M-03** | **12** | **10 M-03** | **28** | **38 J** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **170** | **150** | -- | **7.3** | **20** | **14** | **7.7** | **7.7 M-03** | **7.8** | **25** | **68** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **1300** | **1100 M-03** | **1000 M-03** | **150** | **320** | **230** | **140** | **150 M-03** | **130** | **210** | **740** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **130** | **130 M-03** | -- | **15** | **34** | **23** | **13** | **13** | **13** | **28** | **93** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <0.94 U | <0.96 U | -- | <4.1 U | <4.7 U | <4.2 U | <1 U | <0.93 U | <0.93 U | **0.13 JM-03** | <40 U |
| Perfluorononanoic acid (PFNA) | ng/l | **110 M-03** | **110 M-03** | -- | **11** | **13** | **8.6** | **3.6** | **3.1 M-03** | **2.8 M-03** | **15 M-03** | **34 J** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <50 U | **1.4 JM-03** | **1.7 JM-03** | <4.1 U | <4.7 U | <4.2 U | <1 U | <0.93 U | <0.93 U | **1.8 M-03** | <40 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **19000 M-03** | **17000 BHM-03** | **17000 HM-03** | **1200** | **1400** | **1000** | **540** | **630 BM-03** | **530 BM-03** | **2700 BM-03** | **7900** |
| Perfluorooctanoic acid (PFOA) | ng/l | **270** | **220 M-03** | -- | **26** | **54** | **39** | **23 M-03** | **22 M-03** | **21 M-03** | **40 M-03** | **73** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **32** | **20 M-03** | -- | **9.3** | **23** | **19** | **9.9** | **9.1** | **9.3 M-03** | **8.3** | **23 J** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **140** | **160** | -- | **10** | **24** | **17** | **10** | **9.5** | **9.2** | **23 M-03** | **68** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <0.94 U | <100 UH | -- | <4.1 UQ | <4.7 U | <4.2 UQ | <1 U | <0.93 U | <0.93 U | <0.88 U | <40 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <0.94 U | <0.96 U | -- | <4.1 U | <4.7 U | <4.2 U | <1 U | <0.93 U | <0.93 U | <0.88 U | <40 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <0.94 U | <0.96 U | -- | <4.1 U | <4.7 U | <4.2 U | <1 U | <0.93 U | <0.93 U | <0.88 U | <40 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-L-BB8 | VRTB-L-BB8 | VRTB-L-BB8 | VRTB-L-BB8 | VRTB-L-BB8 | VRTB-L-BB8 | VRTB-L-BB8 | VRTB-L-G4 | VRTB-L-G4 | VRTB-L-G4 | VRTB-L-G4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect |
| Sample Date | | 4/14/2022 | 6/14/2022 | 10/24/2023 | 10/24/2023 | 1/23/2024 | 4/1/2024 | 7/17/2024 | 12/27/2021 | 4/14/2022 | 4/14/2022 | 6/14/2022 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | -- | -- | <3.9 U | <3.9 U | <3.6 U | <3.9 U | -- | -- | -- | -- | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | -- | -- | <3.9 U | <3.9 U | <3.6 U | <3.9 U | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | -- | -- | <24 U | <25 U | <22 U | <24 U | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | -- | -- | **0.68 JM-03** | **0.91 J** | <4.5 U | <4.9 U | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | -- | -- | <24 UM-03 | <25 U | <22 U | <24 U | -- | -- | -- | -- | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | -- | -- | <3.9 U | <3.9 U | <3.6 U | <3.9 U | -- | -- | -- | -- | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <6.9 U | <6.8 U | <3.9 U | <3.9 U | <3.6 U | <3.9 U | -- | <7.8 U | <6.9 U | <7.1 U | <7.5 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | **36** | **15** | **39** | **43** | **52** | **140** | -- | **7.8** | **27** | **28** | **60** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **20** | **10** | **26 M-03** | **25 M-03** | **11** | **18 M-03** | -- | **19** | **18** | **18** | **31** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | -- | -- | <3.9 U | <3.9 U | <3.6 U | <3.9 U | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | <0.97 U | <0.98 U | <0.89 U | <0.98 U | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | <9.7 U | <9.8 U | <500 UH | <9.8 U | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <6.9 U | <6.8 U | <0.97 U | <0.98 U | <0.89 U | <0.98 U | -- | <7.8 U | <6.9 U | <7.1 U | <7.5 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <14 U | <14 U | <0.97 U | <0.98 U | <0.89 U | <0.98 U | -- | <16 U | <14 U | <14 U | <15 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | <9.7 U | <9.8 U | <500 UH | <9.8 U | -- | -- | -- | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <6.9 U | <6.8 U | <0.97 U | <0.98 U | <0.89 U | <0.98 U | -- | <7.8 U | <6.9 U | <7.1 U | <7.5 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | <1.9 U | <2 U | <1.8 U | <2.0 U | -- | -- | -- | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | <1.9 U | <2 U | <1.8 U | <2.0 U | -- | -- | -- | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | **1.3 J** | **2.8** | <1.8 U | <2.0 U | -- | -- | -- | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | <1.9 U | <2 U | <1.8 U | <2.0 U | -- | -- | -- | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **11** | **15** | **31** | **31** | **18** | **26** | -- | **8.2** | **23** | **23** | **15** |
| Perfluorobutanoic acid (PFBA) | ng/l | **32** | **44** | **48** | **52** | **79** | **120** | -- | **13** | **41** | **40** | **53 B** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <3.5 U | <170 U | <0.97 U | <0.98 U | <0.89 U | <0.98 U | -- | <3.9 U | <3.5 U | <3.5 U | <3.7 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <3.5 U | <3.4 U | **0.28 J** | **0.4 JM-03** | <0.89 U | <0.98 U | -- | <3.9 U | <3.5 U | <3.5 U | <3.7 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | <0.97 U | <0.98 U | <0.89 U | <0.98 U | -- | -- | -- | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <3.5 U | <3.4 U | <0.97 U | <0.98 U | <0.89 U | <0.98 U | -- | <3.9 U | <3.5 U | <3.5 U | <3.7 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **46** | **27** | **160 M-03** | **170 M-03** | **190** | **200 M-03** | -- | **10** | **17** | **17** | **36** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **65** | **52** | **89** | **94** | **170** | **380** | -- | **15** | **88** | **91** | **120** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **480** | **540** | **1400 M-03** | **1500 M-03** | **1200** | **3400 M-03** | **2800 M-03** | **160** | **600** | **610** | **1100** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **83** | **100** | **220** | **210** | **230** | **430** | -- | **21** | **170** | **170** | **190** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <3.5 U | <170 U | **0.38 JM-03** | **0.44 JM-03** | <0.89 U | <0.98 U | -- | <3.9 U | <3.5 U | <3.5 U | <3.7 U |
| Perfluorononanoic acid (PFNA) | ng/l | **41** | **24** | **52 M-03** | **55 M-03** | **49 M-03** | **100 M-03** | -- | **5.4** | **7.5** | **7.8** | **18** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <3.5 U | <3.4 U | **1.3 M-03** | **1.5 M-03** | **1.1 JM-03** | **1.4 M-03** | <9.1 U | <3.9 U | <3.5 U | <3.5 U | <3.7 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **6400** | **5800** | **14000 HM-03** | **13000 HM-03** | **14000 HM-03** | **14000 HM-03** | **17000 HM-03** | **1000** | **1200** | **1200** | **2100** |
| Perfluorooctanoic acid (PFOA) | ng/l | **110** | **54** | **150 M-03** | **150 M-03** | **200** | **410 M-03** | -- | **28** | **74** | **70** | **130** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **21** | **25** | **85 M-03** | **89** | **64** | **91** | -- | **11** | **35** | **34** | **45** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **74** | **110** | **91** | **99** | **190** | **320** | -- | **20** | **120** | **120** | **95** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <3.5 U | <170 U | <0.97 U | <0.98 U | <0.89 U | <0.98 U | -- | <3.9 UQ | <3.5 U | <3.5 U | <3.7 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <3.5 U | <3.4 U | <0.97 U | <0.98 U | <0.89 U | <0.98 U | -- | <3.9 U | <3.5 U | <3.5 U | <3.7 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <3.5 U | <3.4 U | <0.97 U | <0.98 U | <0.89 U | <0.98 U | -- | <3.9 U | <3.5 U | <3.5 U | <3.7 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-L-G4 | VRTB-L-G4 | VRTB-L-G4 | VRTB-L-G4 | VRTB-L-G4 | VRTB-L-G4 | VRTB-L-G4 | VRTB-L-M5 | VRTB-L-M5 | VRTB-L-M5 | VRTB-L-M5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect |
| Sample Date | | 10/26/2023 | 1/25/2024 | 1/25/2024 | 4/4/2024 | 4/4/2024 | 7/17/2024 | 7/17/2024 | 12/23/2021 | 4/13/2022 | 6/14/2022 | 10/23/2023 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <3.7 U | <3.8 U | <3.7 U | <38 U | <3.7 U | <3.6 U | <3.5 U | -- | -- | -- | <4.1 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <3.7 U | <3.8 U | <3.7 U | <38 U | <3.7 U | <3.6 U | <3.5 U | -- | -- | -- | <4.1 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <23 U | <24 U | <23 U | <230 U | <23 U | <22 U | <22 U | -- | -- | -- | <25 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <4.6 U | <4.8 U | <4.6 U | <47 U | <4.6 U | <4.5 UL | <4.4 U | -- | -- | -- | **0.86 JM-03** |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <23 U | <24 U | <23 U | <230 U | <23 U | <22 U | <22 U | -- | -- | -- | <25 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <3.7 U | <3.8 U | <3.7 U | <38 U | <3.7 U | <3.6 U | <3.5 U | -- | -- | -- | <4.1 UM-03 |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <3.7 U | <3.8 U | <3.7 U | <38 U | <3.7 U | <3.6 U | <3.5 U | <80 U | <6.9 U | <6.9 U | <4.1 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | **67** | **35** | **41** | **24 JM-03** | **20** | <4.5 U | <4.4 U | **82** | <350 U | **56** | **120** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **78** | **73** | **73** | **64 M-03** | **52 M-03** | **1.6 JM-03** | **1.6 JM-03** | **72 J** | **40** | **30** | **73** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <3.7 U | <3.8 U | <3.7 U | <38 U | <3.7 U | <3.6 U | <3.5 U | -- | -- | -- | <4.1 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <0.92 U | <0.96 U | <0.92 U | <9.4 U | <0.91 U | <0.89 U | <0.89 U | -- | -- | -- | <1 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <9.2 U | <9.6 U | <9.2 UQ | <94 U | <9.1 U | <8.9 UH | <8.9 U | -- | -- | -- | <10 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <0.92 U | <0.96 U | <0.92 U | <9.4 U | <0.91 U | <0.89 U | <0.89 U | <80 U | <6.9 U | <6.9 U | <1 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <0.92 U | <0.96 U | <0.92 U | <9.4 U | <0.91 U | <0.89 U | <0.89 U | <160 U | <14 U | <14 U | <1 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <9.2 U | <9.6 U | <9.2 U | <94 U | <9.1 U | <8.9 U | <8.9 U | -- | -- | -- | <10 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <0.92 U | <0.96 U | <0.92 U | <9.4 U | <0.91 U | <0.89 U | <0.89 U | <80 U | <6.9 U | <6.9 U | <1 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <1.8 U | <1.9 U | <1.8 U | <19 U | <1.8 U | <1.8 U | <1.8 U | -- | -- | -- | <2 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <1.8 U | <1.9 U | <1.8 U | <19 U | <1.8 U | <1.8 U | <1.8 U | -- | -- | -- | <2 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <1.8 U | <1.9 U | <1.8 U | <19 U | <1.8 U | <1.8 U | <1.8 U | -- | -- | -- | <2 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <1.8 U | <1.9 U | <1.8 U | <19 U | <1.8 U | <1.8 U | <1.8 U | -- | -- | -- | <2 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **8.3** | **6.5 M-03** | **5.4** | **5.3 J** | **5.5 M-03** | **5.2** | **5.9 M-03** | <40 U | **6.4** | **9.0** | **18** |
| Perfluorobutanoic acid (PFBA) | ng/l | **27** | **17** | **17** | **17 JM-03** | **17** | **6.6** | **6.9** | **24 J** | **22** | **36 B** | **90** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <0.92 U | <0.96 U | <0.92 U | <9.4 U | <0.91 U | <0.89 U | <0.89 U | <40 U | <3.5 U | <3.5 U | <1 U |
| Perfluorodecanoic acid (PFDA) | ng/l | **0.35 JM-03** | **0.21 JM-03** | **0.29 JM-03** | <9.4 U | <0.91 U | <0.89 U | <0.89 U | <40 U | <3.5 U | <3.5 U | <1 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <0.92 U | <0.96 U | <0.92 U | <9.4 U | <0.91 U | <0.89 U | <0.89 U | -- | -- | -- | <1 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <0.92 U | <0.96 U | <0.92 U | <9.4 U | <0.91 U | <0.89 U | <0.89 U | <40 U | <3.5 U | <3.5 U | <1 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **75** | **45 M-03** | **45** | **24 M-03** | **30** | **9.2 M-03** | **9.3** | **36 J** | **28** | **32** | **150** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **69** | **40** | **40** | **34** | **32** | **6.8** | **7.0 M-03** | **85** | **37** | **110** | **240** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **570 HM-03** | **450 M-03** | **450 M-03** | **320** | **310** | **120 M-03** | **130** | **620** | **390** | **510** | **1700 M-03** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **79 M-03** | **42** | **41** | **32 M-03** | **34** | **11** | **12** | **80** | **43** | **97** | **270** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <0.92 U | **0.22 JM-03** | **0.29 JM-03** | <9.4 U | <0.91 U | <0.89 U | <0.89 U | <40 U | <3.5 U | <3.5 U | <1 U |
| Perfluorononanoic acid (PFNA) | ng/l | **28 M-03** | **28** | **28** | **20 M-03** | **20 M-03** | **2.8 M-03** | **2.6 M-03** | **50** | **31** | **44** | **63 M-03** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | **1.7** | **1.6 M-03** | **1.9 M-03** | <9.4 U | **1.9** | <0.89 U | <0.89 U | <40 U | <3.5 U | <3.5 U | **1.3 M-03** |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **4800 HM-03** | **4500 BM-03** | **4000 BM-03** | **3100 BM-03** | **3200 BM-03** | **460 BM-03** | **440 BM-03** | **11000** | **7100** | **7100** | **12000 HM-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **140** | **68 M-03** | **67 M-03** | **62 M-03** | **55** | **17 M-03** | **17 M-03** | **110** | **65** | **100** | **240 M-03** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **23** | **13** | **14** | **11** | **9.8 M-03** | **9.5 M-03** | **9.0** | **10 J** | **9.9** | **19** | **60** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **64** | **35** | **36** | **29 M-03** | **29** | **8.8 M-03** | **8.8 M-03** | **83** | **48** | **79** | **210** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <0.92 U | <0.96 U | <0.92 U | <9.4 U | <0.91 U | <0.89 U | <0.89 U | <40 U | <3.5 U | <3.5 U | <1 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <0.92 U | <0.96 U | <0.92 U | <9.4 U | <0.91 U | <0.89 U | <0.89 U | <40 U | <3.5 U | <3.5 U | <1 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <0.92 U | <0.96 U | <0.92 U | <9.4 U | <0.91 U | <0.89 U | <0.89 U | <40 U | <3.5 U | <3.5 U | <1 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-L-M5 | VRTB-L-M5 | VRTB-L-M5 | VRTB-L-P7 | VRTB-L-P7 | VRTB-L-P7 | VRTB-L-P7 | VRTB-L-P7 | VRTB-L-P7 | VRTB-L-P7 | VRTB-L-S2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect |
| Sample Date | | 1/24/2024 | 4/1/2024 | 7/17/2024 | 12/23/2021 | 4/14/2022 | 6/14/2022 | 10/24/2023 | 1/23/2024 | 4/1/2024 | 7/17/2024 | 12/27/2021 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <3.8 U | <3.8 U | -- | -- | -- | -- | <3.8 U | <3.9 U | <3.5 U | -- | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <3.8 U | <3.8 U | -- | -- | -- | -- | <3.8 U | <3.9 U | <3.5 U | -- | -- |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <24 U | <24 U | -- | -- | -- | -- | <24 U | <24 U | <22 U | -- | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <4.8 U | <4.7 U | -- | -- | -- | -- | **2 J** | **1.7 JM-03** | **1.5 JM-03** | -- | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <24 UM-03 | <24 U | -- | -- | -- | -- | <24 U | <24 U | <22 U | -- | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <3.8 U | <3.8 U | -- | -- | -- | -- | <3.8 U | <3.9 U | <3.5 U | -- | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <3.8 U | <3.8 U | -- | <80 U | <80 U | <6.9 U | <3.8 U | <3.9 U | <3.5 U | -- | <8.1 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | **110** | **83** | -- | **60 J** | **80** | **77** | **82** | **120** | **140** | -- | <8.1 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **44** | **34** | -- | **29 J** | **32 J** | **39** | **44 M-03** | **38** | **37** | -- | **3.8 J** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <3.8 U | <3.8 U | -- | -- | -- | -- | <3.8 U | <3.9 U | <3.5 U | -- | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <0.96 U | <0.95 U | -- | -- | -- | -- | <0.96 U | <0.97 U | <0.88 U | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <9.6 U | <500 UH | -- | -- | -- | -- | <9.6 U | <9.7 U | <500 UH | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <0.96 U | <0.95 U | -- | <80 U | <80 U | <6.9 U | <0.96 U | <0.97 U | <0.88 U | -- | <8.1 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <0.96 U | <0.95 U | -- | <160 U | <160 U | <14 U | <0.96 U | <0.97 U | <0.88 U | -- | <16 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <9.6 U | <500 UH | -- | -- | -- | -- | <9.6 U | <9.7 UQ | <500 UH | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <0.96 U | <0.95 U | -- | <80 U | <80 U | <6.9 U | <0.96 U | <0.97 U | <0.88 U | -- | <8.1 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <1.9 U | <1.9 U | -- | -- | -- | -- | <1.9 U | <1.9 U | <1.8 U | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <1.9 U | <1.9 U | -- | -- | -- | -- | <1.9 U | <1.9 U | <1.8 U | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <1.9 U | <1.9 U | -- | -- | -- | -- | <1.9 U | <1.9 U | <1.8 U | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <1.9 U | <1.9 U | -- | -- | -- | -- | <1.9 U | <1.9 U | <1.8 U | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **6.3** | **5.2 M-03** | -- | <40 U | <40 U | **10** | **13** | **13** | **11 M-03** | -- | **10** |
| Perfluorobutanoic acid (PFBA) | ng/l | **34** | **30 M-03** | -- | **23 J** | **33 J** | **37** | **53** | **61** | **57 M-03** | -- | **9.4** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <0.96 U | <0.95 U | -- | <40 U | <40 U | <340 U | <0.96 U | <0.97 U | <0.88 U | -- | <4.1 U |
| Perfluorodecanoic acid (PFDA) | ng/l | **0.38 J** | **0.25 JM-03** | -- | <40 U | <40 U | <3.4 U | <0.96 U | <0.97 U | <0.88 U | -- | <4.1 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <0.96 U | <0.95 U | -- | -- | -- | -- | <0.96 U | <0.97 U | <0.88 U | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <0.96 U | <0.95 U | -- | <40 U | <40 U | <3.4 U | <0.96 U | <0.97 U | <0.88 U | -- | <4.1 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **160** | **64** | -- | **40** | **59** | **65** | **150** | **200** | **140** | -- | **10** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **110** | **82** | -- | **96** | **86** | **92** | **120** | **160** | **190** | -- | **8.8** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **850** | **650 M-03** | -- | **820** | **830** | **790** | **1200 M-03** | **1600** | **1300 M-03** | **1500 M-03** | **190 S** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **91** | **74** | -- | **90** | **93** | **99** | **140** | **190** | **190 M-03** | -- | **18** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <0.96 U | <0.95 U | -- | <40 U | <40 U | <340 U | <0.96 U | <0.97 U | <0.88 U | -- | <4.1 U |
| Perfluorononanoic acid (PFNA) | ng/l | **80 M-03** | **86 M-03** | -- | **39 J** | **46** | **54** | **67 M-03** | **63 M-03** | **73 M-03** | -- | **2.7 J** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <20 U | **1.0 M-03** | -- | <40 U | <40 U | <3.4 U | **2.3 JM-03** | <50 UH | **1.9 M-03** | <4.4 U | <4.1 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **11000 M-03** | **11000 BHM-03** | **10000 HM-03** | **10000** | **13000** | **13000** | **17000 HM-03** | **18000 HM-03** | **20000 BHM-03** | **15000 HM-03** | **430 S** |
| Perfluorooctanoic acid (PFOA) | ng/l | **190** | **130 M-03** | -- | **110** | **150** | **140** | **180 M-03** | **210** | **260 M-03** | -- | **32** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **22** | **13 M-03** | -- | **15 J** | **17 J** | **24** | **35** | **53** | **39 M-03** | -- | **14** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **95** | **83** | -- | **74** | **81** | **88** | **110** | **160** | **160** | -- | **14** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <0.96 U | <50 UH | -- | <40 U | <40 U | <340 U | <0.96 U | <0.97 U | <50 UH | -- | <4.1 UQ |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <0.96 U | <0.95 U | -- | <40 U | <40 U | <3.4 U | <0.96 U | <0.97 U | <0.88 U | -- | <4.1 US |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <0.96 U | <0.95 U | -- | <40 U | <40 U | <3.4 U | <0.96 U | <0.97 U | <0.88 U | -- | <4.1 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-L-S2 | VRTB-L-S2 | VRTB-L-S2 | VRTB-L-S2 | VRTB-L-S2 | VRTB-L-S2 | VRTB-L-S2 | VRTB-L-Y3 | VRTB-L-Y3 | VRTB-L-Y3 | VRTB-L-Y3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect | Longsect |
| Sample Date | | 4/14/2022 | 6/14/2022 | 6/14/2022 | 10/26/2023 | 1/25/2024 | 4/4/2024 | 7/17/2024 | 12/27/2021 | 4/14/2022 | 6/14/2022 | 10/26/2023 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | -- | -- | -- | <4 U | <3.5 U | <3.8 U | <3.6 US | -- | -- | -- | <3.5 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | -- | -- | -- | <4 U | <3.5 U | <3.8 U | <3.6 U | -- | -- | -- | <3.5 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | -- | -- | -- | <25 U | <22 U | <24 U | <22 U | -- | -- | -- | <22 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | -- | -- | -- | <4.9 U | <4.4 U | <4.8 U | <4.5 U | -- | -- | -- | <4.4 U |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | -- | -- | -- | <25 U | <22 U | <24 U | <22 U | -- | -- | -- | <22 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | -- | -- | -- | <4 U | <3.5 U | <3.8 U | <3.6 U | -- | -- | -- | <3.5 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <6.9 U | <9.1 U | <8.0 U | <4 U | <3.5 U | <3.8 U | <3.6 U | <8.0 U | <6.8 U | <7.5 U | <3.5 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | **2.0 J** | **86** | **80** | **5.6** | **4.3 JM-03** | **2.8 J** | **2.5 JM-03** | **5.5 J** | **42** | **130** | **11 M-03** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **5.4 J** | **45** | **38** | **11** | **9.7** | **6.4** | **5.7 M-03** | **15** | **69** | **93** | **140** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | -- | -- | -- | <4 U | <3.5 U | <3.8 U | <3.6 U | -- | -- | -- | <3.5 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | -- | <0.99 U | <0.88 U | <0.95 U | <0.90 U | -- | -- | -- | <0.89 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | -- | <50 UH | <8.8 UQ | <9.5 U | <9.0 U | -- | -- | -- | <8.9 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <6.9 U | <9.1 U | <8.0 U | <0.99 U | <0.88 U | <0.95 U | <0.90 U | <8.0 U | <6.8 U | <7.5 U | <0.89 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <14 U | <18 U | <16 U | <0.99 U | <0.88 U | <0.95 U | <0.90 U | <16 U | <14 U | <15 U | <0.89 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | -- | <50 UH | <8.8 UQ | <9.5 U | <9.0 U | -- | -- | -- | <8.9 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <6.9 U | <9.1 U | <8.0 U | <0.99 U | <0.88 U | <0.95 U | <0.90 U | <8.0 U | <6.8 U | <7.5 U | <0.89 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | -- | <2 U | <1.8 U | <1.9 U | <1.8 U | -- | -- | -- | <1.8 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | -- | <2 U | <1.8 U | <1.9 U | <1.8 U | -- | -- | -- | <1.8 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | -- | <2 U | <1.8 U | <1.9 U | <1.8 U | -- | -- | -- | <1.8 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | -- | <2 U | <1.8 U | <1.9 U | <1.8 U | -- | -- | -- | <1.8 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **10** | **13** | **11** | **5.1 M-03** | **5.3** | **5.8 M-03** | **6.0 M-03** | **5.4** | **16** | **6.1** | **5.2** |
| Perfluorobutanoic acid (PFBA) | ng/l | **10** | **27 B** | **23 B** | **8.3** | **8.1** | **8.3 M-03** | **8.1 M-03** | **14** | **50** | **53 B** | **9.8** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <3.4 U | <4.6 U | <4.0 U | <0.99 U | <0.88 U | <0.95 U | <0.90 U | <4.0 U | <3.4 U | <3.7 U | <0.89 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <3.4 U | <4.6 U | <4.0 U | <0.99 U | <0.88 U | <0.95 U | <0.90 U | <4.0 U | <3.4 U | <3.7 U | **0.41 JM-03** |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | -- | <0.99 U | <0.88 US | <0.95 U | <0.90 US | -- | -- | -- | <0.89 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <3.4 U | <4.6 U | <4.0 U | <0.99 U | <0.88 U | <0.95 U | <0.90 U | <4.0 U | <3.4 U | <3.7 U | <0.89 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **11** | **51** | **44** | **15 M-03** | **14 M-03** | **13** | **12** | **9.1** | **100** | **90** | **45** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **10** | **46** | **49** | **11** | **11** | **9.2** | **9.2** | **11** | **110** | **110** | **20** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **210** | **720** | **1100** | **210 M-03** | **200 M-03** | **150** | **150 M-03** | **130** | **1200** | **2300** | **370 M-03** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **24** | **74** | **62** | **16 M-03** | **14** | **14 M-03** | **14** | **18** | **200** | **130** | **26 M-03** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <3.4 U | <4.6 U | <4.0 U | <0.99 U | <0.88 U | <0.95 U | <0.90 U | <4.0 U | <3.4 U | <3.7 U | **0.65 JM-03** |
| Perfluorononanoic acid (PFNA) | ng/l | **3.1 J** | **50** | **44** | **5.4** | **4.4 M-03** | **4.7 M-03** | **3.6 M-03** | **3.7 J** | **44** | **45** | **18** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <3.4 U | <4.6 U | <4.0 U | **1.2 M-03** | **1.3 M-03** | **1.2 M-03** | **1.1 M-03** | <4.0 U | **1.0 J** | **1.7 J** | **4.2 M-03** |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **670** | **3900** | **5600** | **920 M-03** | **950 BM-03** | **620 BHM-03** | **700 BM-03** | **720** | **4400** | **4500** | **3100 M-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **33** | **200** | **180** | **28** | **29 M-03** | **27 M-03** | **23 M-03** | **23** | **150** | **410** | **43** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **16** | **27** | **23** | **10 M-03** | **9.7** | **9.5** | **9.2 M-03** | **7.9** | **41** | **24** | **14** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **14** | **26** | **27** | **12** | **10** | **10 M-03** | **10 M-03** | **14** | **110** | **72** | **21** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <3.5 U | <4.6 UQ | <4.0 UQ | <0.99 U | <0.88 U | <0.95 U | <0.90 U | <4.0 UQ | <3.4 U | <3.7 U | <0.89 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <3.4 U | <4.6 U | <4.0 U | <0.99 U | <0.88 U | <0.95 U | <0.90 U | <4.0 U | <3.4 U | <3.7 U | <0.89 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <3.4 U | <4.6 U | <4.0 U | <0.99 U | <0.88 U | <0.95 U | <0.90 U | <4.0 U | <3.4 U | <3.7 U | <0.89 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-L-Y3 | VRTB-L-Y3 | VRTB-L-Y3 | VRTB-S-06 | VRTB-S-06 | VRTB-S-06 | VRTB-S-06 | VRTB-S-06 | VRTB-S-06 | VRTB-S-B1 | VRTB-S-B1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Longsect | Longsect | Longsect | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow |
| Sample Date | | 1/25/2024 | 4/4/2024 | 7/17/2024 | 4/14/2022 | 6/14/2022 | 8/24/2022 | 10/26/2023 | 4/2/2024 | 7/16/2024 | 12/23/2021 | 4/14/2022 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | <8.4 U | -- | -- | -- | -- | -- | -- | <7.9 U |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <3.8 U | <3.8 U | <3.5 U | -- | -- | -- | <3.8 U | <3.8 U | <3.5 U | -- | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <3.8 U | <3.8 U | <3.5 U | <8.4 U | -- | -- | <3.8 U | <3.8 U | <3.5 U | -- | <7.9 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <24 U | <23 U | <22 U | -- | -- | -- | <24 U | <24 U | <22 U | -- | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <4.7 U | <4.7 U | <4.4 U | -- | -- | -- | <4.8 U | <4.7 U | <4.3 U | -- | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <24 U | <23 U | <22 U | -- | -- | -- | <24 U | <24 U | <22 U | -- | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <3.8 U | <3.8 U | <3.5 U | -- | -- | -- | <3.8 U | <3.8 U | <3.5 U | -- | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <3.8 U | <3.8 U | <3.5 U | <8.4 U | <6.8 U | <6.9 U | <3.8 UQ | <3.8 U | <3.5 U | <7.9 U | <7.9 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | **6.7** | **4.5 J** | **5.6 M-03** | **2.5 J** | <68 U | <6.9 U | **2.6 JM-03** | **6.1 M-03** | **3.2 JM-03** | <7.9 U | <7.9 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **77** | **46** | **41 M-03** | **2.4 J** | <6.8 U | **2.2 J** | **1.7 JM-03** | **1.1 JM-03** | **1.0 J** | <7.9 U | <7.9 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <3.8 U | <3.8 U | <3.5 U | -- | -- | -- | <3.8 U | <3.8 U | <3.5 U | -- | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <0.95 U | <0.94 U | <0.88 U | <8.4 U | -- | -- | <0.96 U | <0.94 U | <0.87 U | -- | <7.9 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <9.5 UQ | <9.4 U | <8.8 U | -- | -- | -- | <9.6 U | <9.4 U | <8.7 U | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <0.95 U | <0.94 U | <0.88 U | <8.4 U | <6.8 U | <6.9 U | <0.96 U | <0.94 U | <0.87 U | <7.9 U | <7.9 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <0.95 U | <0.94 U | <0.88 U | <17 U | <14 U | <14 U | <0.96 U | <0.94 U | <0.87 U | <16 U | <16 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <50 UH | <9.4 U | <8.8 U | -- | -- | -- | <9.6 U | <9.4 U | <8.7 U | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <0.95 U | <0.94 U | <0.88 U | <8.4 U | <6.8 U | <6.9 U | <0.96 U | <0.94 U | <0.87 U | <7.9 U | <7.9 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <1.9 U | <1.9 U | <1.8 U | -- | -- | -- | <1.9 U | <1.9 U | <1.7 U | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <1.9 U | <1.9 U | <1.8 U | -- | -- | -- | <1.9 U | <1.9 U | <1.7 U | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <1.9 U | <1.9 UM-03 | <1.8 U | -- | -- | -- | <1.9 U | <1.9 U | <1.7 U | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <1.9 U | <1.9 U | <1.8 U | -- | -- | -- | <1.9 U | <1.9 U | <1.7 U | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **4** | **4.2 M-03** | **4.7 M-03** | **11** | **17** | **4.3** | **8** | **14** | **9.1** | **1.4 J** | **2.8 J** |
| Perfluorobutanoic acid (PFBA) | ng/l | **8.7** | **8.9** | **8.4** | **12** | **15** | **10** | **15** | **14** | **8.9 M-03** | <4.0 U | **2.1 J** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <0.95 U | <0.94 U | <0.88 U | <4.2 U | <3.4 U | <3.5 U | **0.2 J** | <0.94 U | <0.87 U | <4.0 U | <4.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <0.95 U | <0.94 U | <0.88 U | <4.2 U | **0.97 J** | <3.5 U | **0.76 JM-03** | **0.59 JM-03** | **1.3** | <4.0 U | <4.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <0.95 U | <0.94 U | <0.88 U | -- | -- | -- | <0.96 U | <0.94 U | <0.87 U | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <0.95 U | <0.94 U | <0.88 U | <4.2 U | <3.4 U | <3.5 U | <0.96 U | <0.94 U | <0.87 U | <4.0 U | <4.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **17** | **15 M-03** | **13** | **34** | **29** | **27** | **65 M-03** | **110 M-03** | **130** | **1.0 J** | <4.0 U |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **13** | **12** | **13** | **19** | **25** | **14** | **20** | **23** | **15 M-03** | **1.5 J** | <4.0 U |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **150 M-03** | **140 M-03** | **120** | **400** | **520** | **250** | **510 M-03** | **1100 M-03** | **580 M-03** | **17** | **24** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **14** | **13** | **14 M-03** | **31** | **46** | **16** | **39 M-03** | **49** | **23** | **2.5 J** | **1.3 J** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | **0.26 JM-03** | **0.26 JM-03** | **0.31 JM-03** | <4.2 U | <3.4 U | <3.5 U | **0.75 JM-03** | **0.69 JM-03** | **0.74 JM-03** | <4.0 U | <4.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | **8.1** | **6.4 M-03** | **4.8 M-03** | **5.9** | **8.0** | **7.5** | **8.1 M-03** | **8.6 M-03** | **9.5 M-03** | <4.0 U | <4.0 U |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | **3.5 M-03** | **3.1 M-03** | **3.0 M-03** | **3.4 J** | **3.6** | **4.5** | **4.9 M-03** | **6.3 M-03** | **7.8 M-03** | <4.0 U | <4.0 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **1700 BM-03** | **1200 BM-03** | **990 BM-03** | **2000** | **1900** | **1800** | **1700 M-03** | **1800 HM-03** | **2200 BM-03** | **180** | **130** |
| Perfluorooctanoic acid (PFOA) | ng/l | **25 M-03** | **24 M-03** | **22 M-03** | **41** | **40** | **28** | **42** | **100 M-03** | **68 M-03** | **2.5 J** | **1.6 J** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **6.3** | **6.0 M-03** | **7.1 M-03** | **22** | **34** | **9.2** | **29** | **44 M-03** | **22** | **1.1 J** | **1.6 J** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **13** | **12 M-03** | **12** | **16** | **23 B** | **7.2** | **25** | **25 M-03** | **13 M-03** | **2.7 J** | **1.2 J** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <5 UH | <0.94 U | <0.88 U | <4.2 U | <3.4 U | <3.5 U | <0.96 U | <0.94 U | <0.87 U | <4.0 U | <4.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <0.95 U | <0.94 U | <0.88 U | <4.2 U | <3.4 U | <3.5 U | <0.96 U | <0.94 U | <0.87 U | <4.0 U | <4.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <0.95 U | <0.94 U | <0.88 U | <4.2 U | <3.4 U | <3.5 U | <0.96 U | <0.94 U | <0.87 U | <4.0 U | <4.0 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-S-B1 | VRTB-S-B1 | VRTB-S-B1 | VRTB-S-B1 | VRTB-S-B1 | VRTB-S-B1 | VRTB-S-G4 | VRTB-S-G4 | VRTB-S-G4 | VRTB-S-G4 | VRTB-S-G4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow |
| Sample Date | | 6/13/2022 | 8/22/2022 | 10/24/2023 | 1/23/2024 | 4/3/2024 | 7/15/2024 | 12/23/2021 | 4/14/2022 | 4/19/2022 | 6/13/2022 | 8/23/2022 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | <7.8 U | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | -- | -- | <3.5 U | <3.8 U | <3.7 U | <3.5 U | -- | -- | -- | -- | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | -- | -- | <3.5 U | <3.8 U | <3.7 U | <3.5 U | -- | <7.8 U | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | -- | -- | <22 U | <24 U | <23 U | <22 U | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | -- | -- | <4.4 U | <4.7 U | <4.6 U | <4.4 U | -- | -- | -- | -- | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | -- | -- | <22 U | <24 U | <23 U | <22 U | -- | -- | -- | -- | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | -- | -- | <3.5 U | <3.8 U | <3.7 U | <3.5 U | -- | -- | -- | -- | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <6.9 U | <8.5 U | <3.5 U | <3.8 U | <3.7 U | <3.5 U | <7.9 U | <7.8 U | -- | <7.0 U | <6.9 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <6.9 U | <8.5 U | <4.4 U | <4.7 U | <4.6 U | <4.4 U | <7.9 U | <7.8 U | -- | <7.0 U | <6.9 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <6.9 U | <8.5 U | <3.5 U | <3.8 U | <3.7 U | <3.5 U | <7.9 U | <7.8 U | -- | <7.0 U | <6.9 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | -- | -- | <3.5 U | <3.8 U | <3.7 U | <3.5 U | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | <0.88 U | <0.94 U | <0.93 U | <0.89 U | -- | <7.8 U | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | <8.8 U | <9.4 U | <9.3 U | <8.9 U | -- | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <6.9 U | <8.5 U | <0.88 U | <0.94 U | <0.93 U | <0.89 U | <7.9 U | <7.8 U | -- | <7.0 U | <6.9 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <14 U | <17 U | <0.88 U | <0.94 U | <0.93 U | <0.89 U | <16 U | <16 U | -- | <14 U | <14 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | <8.8 U | <9.4 U | <9.3 U | <8.9 U | -- | -- | -- | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <6.9 U | <8.5 U | <0.88 U | <0.94 U | <0.93 U | <0.89 U | <7.9 U | <7.8 U | -- | <7.0 U | <6.9 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | <1.8 U | <1.9 U | <1.9 U | <1.8 U | -- | -- | -- | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | <1.8 U | <1.9 U | <1.9 U | <1.8 U | -- | -- | -- | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | <1.8 U | <1.9 U | <1.9 U | <1.8 U | -- | -- | -- | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | <1.8 U | <1.9 U | <1.9 U | <1.8 U | -- | -- | -- | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **2.6 J** | **2.8 J** | **3** | **2.3** | **3.8** | **3.1 M-03** | **6.8** | **12** | -- | **9.2** | **10** |
| Perfluorobutanoic acid (PFBA) | ng/l | **3.2 J** | **2.7 J** | **5.5 M-03** | **4.8** | **5.2** | **4.1 M-03** | **2.7 J** | **9.0** | -- | **6.7** | **5.6** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <3.4 U | <4.3 U | <0.88 U | <0.94 U | <0.93 U | <0.89 U | <4.0 U | <3.9 U | -- | <3.5 U | <3.4 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <3.4 U | <4.3 U | <0.88 U | <0.94 U | <0.93 U | <0.89 U | <4.0 U | <3.9 U | -- | <3.5 U | <3.4 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | <0.88 U | <0.94 U | <0.93 U | <0.89 U | -- | -- | -- | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <3.4 U | <4.3 U | <0.88 U | <0.94 U | <0.93 U | <0.89 U | <4.0 U | <3.9 U | -- | <3.5 U | <3.4 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **0.91 J** | **1.1 J** | **1.2** | **1.2** | **1.0 M-03** | **1.2 M-03** | **7.5** | **28** | -- | **13** | **11** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **1.1 J** | **1.3 J** | **2.8** | **2.1** | **3.0 M-03** | **2.9 M-03** | **2.5 J** | **12** | -- | **6.7** | **5.7** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **25** | **34** | **30 M-03** | **30** | **33** | **27 M-03** | **160** | **530** | -- | **350** | **360 H** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **1.7 J** | **2.4 J** | **7.9** | **4.6** | **5.8 M-03** | **3.8 M-03** | **3.4 J** | **32** | -- | **16** | **14** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <3.4 U | <4.3 U | <0.88 U | <0.94 U | <0.93 U | <0.89 U | <4.0 U | <3.9 U | -- | <3.5 U | <3.4 U |
| Perfluorononanoic acid (PFNA) | ng/l | <3.4 U | <4.3 U | **0.37 JM-03** | <0.94 U | **0.34 JM-03** | **0.31 JM-03** | **1.5 J** | **1.8 J** | -- | **1.4 J** | **1.6 J** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <3.4 U | **3.9 J** | <0.88 U | <0.94 U | <0.93 U | <0.89 U | <4.0 U | <3.9 U | -- | <3.5 U | <3.4 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **140** | **240** | **180 M-03** | **110 B** | **130 M-03** | **150 M-03** | **570** | **1200** | -- | **680** | **760 H** |
| Perfluorooctanoic acid (PFOA) | ng/l | **1.7 J** | **2.1 J** | **2.5 M-03** | **1.9 M-03** | **2.6** | **2.9 M-03** | **4.5** | **18** | -- | **9.4** | **9.5** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **1.9 J** | **2.1 J** | **1.8** | **1.6** | **2.2 M-03** | **1.6 M-03** | **8.7** | **25** | -- | **20** | **17** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **1.6 J** | **2.4 J** | **8** | **4.2** | **4.8 M-03** | **3.3 M-03** | **1.6 J** | **11** | -- | **6.4** | **5.8** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <3.4 U | <4.3 U | <0.88 U | <0.94 U | <0.93 U | <0.89 U | <4.0 U | <3.9 U | -- | <3.5 U | <3.4 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <3.4 U | <4.3 U | <0.88 U | <0.94 U | <0.93 U | <0.89 U | <4.0 U | <3.9 U | -- | <3.5 U | <3.4 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <3.4 U | <4.3 U | <0.88 U | <0.94 U | <0.93 U | <0.89 U | <4.0 U | <3.9 U | -- | <3.5 U | <3.4 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-S-G4 | VRTB-S-G4 | VRTB-S-G4 | VRTB-S-G4 | VRTB-S-G4 | VRTB-S-M5 | VRTB-S-M5 | VRTB-S-M5 | VRTB-S-M5 | VRTB-S-M5 | VRTB-S-M5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow |
| Sample Date | | 10/25/2023 | 10/25/2023 | 1/23/2024 | 4/3/2024 | 7/15/2024 | 12/15/2021 | 4/19/2022 | 6/14/2022 | 8/24/2022 | 10/26/2023 | 1/25/2024 |
| **Analyte** | **Units** | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <4 U | <3.8 U | <20 U | <3.7 U | <3.6 U | -- | -- | -- | -- | <4 U | <3.8 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <4 U | <3.8 U | <20 U | <3.7 U | <3.6 U | -- | -- | -- | -- | <4 U | <3.8 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <25 U | <24 U | <130 U | <23 U | <22 U | -- | -- | -- | -- | <25 U | <24 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <5 U | <4.8 U | <25 U | <4.6 U | <4.4 U | -- | -- | -- | -- | <5 U | <4.7 U |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <25 U | <24 U | <130 U | <23 U | <22 U | -- | -- | -- | -- | <25 U | <24 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <4 U | <3.8 U | <20 U | <3.7 U | <3.6 U | -- | -- | -- | -- | <4 U | <3.8 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <4 U | <3.8 U | <20 U | <3.7 U | <3.6 U | <7.9 U | <7.0 U | <6.9 UQ | <6.8 U | <4 UQ | <3.8 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <5 U | <4.8 U | <25 U | <4.6 U | <4.4 U | **6.4 J** | **13** | **19 H** | **12** | **11 M-03** | **58** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <4 U | <3.8 U | <20 U | <3.7 U | <3.6 U | **3.7 J** | **6.5 J** | **5.5 J** | **8.7** | **11** | **34 M-03** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <4 U | <3.8 U | <20 U | <3.7 U | <3.6 U | -- | -- | -- | -- | <4 U | <3.8 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | -- | -- | -- | -- | <0.99 U | <0.95 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <9.9 U | <9.6 U | <50 U | <9.3 U | <8.9 U | -- | -- | -- | -- | <9.9 U | <9.5 UQ |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | <7.9 U | <7.0 U | <6.9 U | <6.8 U | <0.99 U | <0.95 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | <16 U | <14 U | <14 U | <14 U | <0.99 U | <0.95 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <9.9 U | <9.6 U | <50 U | <9.3 U | <8.9 U | -- | -- | -- | -- | <9.9 U | <9.5 UQ |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | <7.9 U | <7.0 U | <6.9 U | <6.8 U | <0.99 U | <0.95 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <2 U | <1.9 U | <10 U | <1.9 U | <1.8 U | -- | -- | -- | -- | <2 U | <1.9 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <2 U | <1.9 U | <10 U | <1.9 U | <1.8 U | -- | -- | -- | -- | <2 U | <1.9 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <2 U | <1.9 U | <10 U | <1.9 U | <1.8 U | -- | -- | -- | -- | <2 U | <1.9 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <2 U | <1.9 U | <10 U | <1.9 U | <1.8 U | -- | -- | -- | -- | <2 U | <1.9 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **8.5** | **8.3** | **7.1 M-03** | **9.1 M-03** | **6.4** | **3.3 J** | **3.6** | **6.0** | **4.9** | **5** | **7.3** |
| Perfluorobutanoic acid (PFBA) | ng/l | **9** | **8.9** | **5.4 J** | **7.2** | **4.3 M-03** | **9.1** | **14** | **25** | **16** | **13** | **31 M-03** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | <4.0 U | <3.5 U | <3.5 U | <3.4 U | <0.99 U | <0.95 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | <4.0 U | <3.5 U | <3.5 U | <3.4 U | **0.25 JM-03** | **0.36 J** |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | -- | -- | -- | -- | <0.99 U | <0.95 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | <4.0 U | <3.5 U | <3.5 U | <3.4 U | <0.99 U | <0.95 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **24 M-03** | **23** | **14** | **24** | **17** | **13** | **12** | **17** | **15** | **30** | **65 M-03** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **8.3** | **8.3** | **6.3** | **9.0** | **6.1 M-03** | **17** | **19** | **39** | **23** | **26** | **74** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **500 M-03** | **470 M-03** | **290 M-03** | **550 M-03** | **300 M-03** | **150** | **210** | **330** | **280** | **440** | **860** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **18** | **17** | **12** | **21** | **15** | **24** | **29** | **58** | **35** | **45 M-03** | **100** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 UM-03 | <4.0 U | <3.5 U | <3.5 U | <3.4 U | <0.99 U | **0.24 JM-03** |
| Perfluorononanoic acid (PFNA) | ng/l | **2.6 M-03** | **2.6 M-03** | **0.57 JM-03** | **2.6 M-03** | **2.2 M-03** | **7.6** | **6.4** | **10** | **8.7** | **11 M-03** | **23 M-03** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | <4.0 U | <3.5 U | **3.1 J** | **1.4 J** | **0.48 JM-03** | **0.63 JM-03** |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **1100 M-03** | **1100 M-03** | **800 M-03** | **850** | **950 BM-03** | **1100** | **1300** | **2400** | **2000** | **2500 M-03** | **4400 BM-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **15 M-03** | **14 M-03** | **9.8** | **18 M-03** | **13 M-03** | **25** | **22** | **46** | **29** | **47** | **130 M-03** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **22** | **21** | **13** | **19** | **11** | **6.6** | **5.8** | **9.7** | **9.1** | **16** | **26** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **9** | **9.2** | **7.6 JM-03** | **9.5** | **7.1 M-03** | **19** | **25** | **57 B** | **25** | **29** | **68** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | <4.0 U | <3.5 U | <3.6 UH | <3.5 HU | <0.99 U | <0.95 UQ |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | <4.0 U | <3.5 U | <3.5 U | <3.4 U | <0.99 U | <0.95 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <0.99 U | <0.96 U | <5 U | <0.93 U | <0.89 U | <4.0 U | <3.5 U | <3.5 U | <3.4 U | <0.99 U | <0.95 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-S-M5 | VRTB-S-M5 | VRTB-S-O6 | VRTB-S-O6 | VRTB-S-P8 | VRTB-S-P8 | VRTB-S-P8 | VRTB-S-P8 | VRTB-S-P8 | VRTB-S-P8 | VRTB-S-R7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow |
| Sample Date | | 4/2/2024 | 7/16/2024 | 12/13/2021 | 1/25/2024 | 4/19/2022 | 6/14/2022 | 8/24/2022 | 1/24/2024 | 4/2/2024 | 7/16/2024 | 4/19/2022 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <3.5 U | <3.6 U | -- | <3.8 U | -- | -- | -- | <3.9 U | <3.7 U | <3.6 U | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <3.5 U | <3.6 U | -- | <3.8 U | -- | -- | -- | <3.9 U | <3.7 U | <3.6 U | -- |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <22 U | <23 U | -- | <24 U | -- | -- | -- | <24 U | <23 U | <22 U | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <4.3 U | <4.5 U | -- | <4.8 U | -- | -- | -- | <4.9 U | <4.7 U | <4.5 U | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <22 U | <23 U | -- | <24 U | -- | -- | -- | <24 U | <23 U | <22 U | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <3.5 U | <3.6 U | -- | <3.8 U | -- | -- | -- | <3.9 U | <3.7 U | <3.6 U | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <3.5 U | <3.6 U | <8.0 U | <3.8 U | <7.0 U | <6.8 U | <690 U | <3.9 U | <3.7 U | <3.6 U | <1400 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | **86** | **44** | <8.0 U | **3.2 JM-03** | **5.3 J** | **21** | <690 U | **16** | **24** | **35** | <1400 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **63** | **47** | **2.6 J** | **0.87 JM-03** | **2.1 J** | **6.5 J** | <690 U | <3.9 U | **9.7** | **16** | <1400 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <3.5 U | <3.6 U | -- | <3.8 U | -- | -- | -- | <3.9 U | <3.7 U | <3.6 U | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <0.87 U | <0.90 U | -- | <0.95 U | -- | -- | -- | <0.98 U | <0.94 U | <0.90 U | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <8.7 U | <9.0 U | -- | <9.5 UQ | -- | -- | -- | <200 UH | <9.4 U | <9.0 U | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <0.87 U | <0.90 U | <8.0 U | <0.95 U | <7.0 U | <6.8 U | <690 U | <0.98 U | <0.94 U | <0.90 U | <1400 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <0.87 U | <0.90 U | <16 U | <0.95 U | <14 U | <14 U | <1400 U | <0.98 U | <0.94 U | <0.90 U | <2900 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <8.7 U | <9.0 U | -- | <9.5 UQ | -- | -- | -- | <200 UH | <9.4 U | <9.0 U | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <0.87 U | <0.90 U | <8.0 U | <0.95 U | <7.0 U | <6.8 U | <690 U | <0.98 U | <0.94 U | <0.90 U | <1400 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <1.7 U | <1.8 U | -- | <1.9 U | -- | -- | -- | <2 U | <1.9 U | <1.8 U | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <1.7 U | <1.8 U | -- | <1.9 U | -- | -- | -- | <2 U | <1.9 U | <1.8 U | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <1.7 U | <1.8 U | -- | <1.9 U | -- | -- | -- | <2 U | <1.9 U | <1.8 U | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <1.7 U | <1.8 U | -- | <1.9 U | -- | -- | -- | <2 U | <1.9 U | <1.8 U | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **6.7 M-03** | **5.9 M-03** | **9.7** | **15** | **4.7** | **17** | <340 U | **55** | **47** | **31 M-03** | <720 U |
| Perfluorobutanoic acid (PFBA) | ng/l | **27** | **23** | **8.1** | **16** | **8.2** | **22 H** | <340 U | **18 M-03** | **24 M-03** | **22 M-03** | <720 U |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <0.87 U | <0.90 U | <4.0 U | <0.95 U | <3.5 U | <3.4 U | <340 U | <0.98 U | <0.94 U | <0.90 U | <720 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <0.87 U | **0.45 JM-03** | **1.0 J** | **0.74 JM-03** | <3.5 U | <3.4 U | <340 U | <0.98 U | <0.94 U | <0.90 U | <720 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <0.87 U | <0.90 U | -- | <0.95 U | -- | -- | -- | <0.98 U | <0.94 U | <0.90 U | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <0.87 U | <0.90 U | <4.0 U | <0.95 U | <3.5 U | <3.4 U | <340 U | <0.98 U | <0.94 U | <0.90 U | <720 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **70** | **54** | **34** | **88** | **24** | **63** | <340 U | **130** | **140** | **180** | <720 U |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **92** | **48** | **12** | **16** | **8.0** | **32** | <340 U | **21** | **40** | **37** | <720 U |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **790 M-03** | **510 M-03** | **330** | **520 M-03** | **260** | **720** | **1400** | **790 M-03** | **1300** | **1000 M-03** | **1900** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **87 M-03** | **68 M-03** | **26** | **36** | **14** | **96** | **140 J** | **58** | **78** | **110** | **210 J** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <0.87 U | <0.90 U | <4.0 U | **0.69 JM-03** | <3.5 U | <3.4 U | <340 U | <0.98 U | <0.94 U | **0.57 JM-03** | <720 U |
| Perfluorononanoic acid (PFNA) | ng/l | **31 M-03** | **25 M-03** | **7.4** | **8.1** | **9.6** | **22** | <340 U | **19 M-03** | **36 M-03** | **41 M-03** | <720 U |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | **0.87 M-03** | **0.65 JM-03** | **3.4 J** | **5.6 M-03** | <3.5 U | **1.3 J** | <340 U | **0.26 JQM-03** | **1.6 M-03** | **2.5 M-03** | <720 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **4800 HM-03** | **4600 BM-03** | **2000** | **2000 BM-03** | **5400** | **7300** | **13000** | **9600 BHSM-03** | **9600 HM-03** | **11000 HM-03** | **22000** |
| Perfluorooctanoic acid (PFOA) | ng/l | **140 M-03** | **70 M-03** | **33** | **63 M-03** | **18** | **64** | **150 J** | **60** | **96** | **100** | **270 J** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **22** | **13** | **20** | **33** | **5.4** | **32** | <340 U | **38** | **42 M-03** | **48** | <720 U |
| Perfluoropentanoic acid (PFPeA) | ng/l | **65** | **52** | **15** | **20** | **8.3** | **34 B** | <340 U | **30** | **46 M-03** | **41** | <720 U |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <0.87 U | <0.90 U | <4.0 U | <0.95 U | <3.5 U | <3.4 UQ | <340 U | <0.98 U | <0.94 U | <0.90 U | <720 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <0.87 U | <0.90 U | <4.0 U | <0.95 U | <3.5 U | <3.4 U | <340 U | <0.98 U | <0.94 U | <0.90 U | <720 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <0.87 U | <0.90 U | <4.0 U | <0.95 U | <3.5 U | <3.4 U | <340 U | <0.98 U | <0.94 U | <0.90 U | <720 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

Table 13
PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs
ESTCP Final Report
Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge
Grayling, Michigan

| Location | | VRTB-S-R7 | VRTB-S-R7 | VRTB-S-R7 | VRTB-S-R7 | VRTB-S-R7 | VRTB-S-R7 | VRTB-S-R7 | VRTB-S-R7 | VRTB-S-R7 | VRTB-S-S2 | VRTB-S-S2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow |
| Sample Date | | 6/14/2022 | 8/24/2022 | 10/26/2023 | 1/25/2024 | 1/25/2024 | 4/2/2024 | 4/2/2024 | 7/16/2024 | 7/16/2024 | 12/23/2021 | 4/14/2022 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | <8.4 U |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | -- | -- | <3.7 U | <3.8 U | <3.8 U | <37 U | <3.8 U | <3.5 U | <3.5 U | -- | -- |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | -- | -- | <3.7 U | <3.8 U | <3.8 U | <37 U | <3.8 U | <3.5 U | <3.5 U | -- | <8.4 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | -- | -- | <23 U | <24 U | <24 U | <230 U | <24 U | <22 U | <22 U | -- | -- |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | -- | -- | <4.6 U | <4.8 U | <4.8 U | <46 U | <4.8 U | <4.3 U | <4.3 U | -- | -- |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | -- | -- | <23 U | <24 U | <24 U | <230 U | <24 U | <22 U | <22 U | -- | -- |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | -- | -- | <3.7 U | <3.8 U | <3.8 U | <37 U | <3.8 U | <3.5 U | <3.5 U | -- | -- |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <7.0 U | <1000 U | <3.7 UQ | <3.8 U | <3.8 U | <37 U | <3.8 U | <3.5 U | <3.5 U | <8.4 U | <8.4 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | **89** | <1000 U | **150 HJ** | **130** | **110** | **130** | **140** | **82** | **90** | **8.1 J** | <8.4 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **37** | <1000 U | **63** | **60** | **63** | **56** | **59** | **69 M-03** | **66 M-03** | **6.5 J** | <8.4 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | -- | -- | <3.7 U | <3.8 U | <3.8 U | <37 U | <3.8 U | <3.5 U | <3.5 U | -- | -- |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | <0.93 UQ | <0.96 U | <0.96 U | <9.2 U | <0.96 U | <0.87 U | <0.87 U | -- | <8.4 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | <9.3 U | <500 UH | <1000 UH | <92 U | <9.6 U | <8.7 U | <8.7 U | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <7.0 U | <1000 U | <0.93 U | <0.96 U | <0.96 U | <9.2 U | <0.96 U | <0.87 U | <0.87 U | <8.4 U | <8.4 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <14 U | <2000 U | <0.93 UQ | <0.96 U | <0.96 U | <9.2 U | <0.96 U | <0.87 U | <0.87 U | <17 U | <17 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | <9.3 U | <500 UH | <1000 UH | <92 U | <9.6 U | <8.7 U | <8.7 U | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <7.0 U | <1000 U | <0.93 UQ | <0.96 U | <0.96 U | <9.2 U | <0.96 U | <0.87 U | <0.87 U | <8.4 U | <8.4 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | <1.9 U | <1.9 U | <1.9 U | <18 U | <1.9 U | <1.7 U | <1.7 U | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | <1.9 U | <1.9 U | <1.9 U | <18 U | <1.9 U | <1.7 U | <1.7 U | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | <1.9 U | <1.9 U | <1.9 U | <18 U | <1.9 U | <1.7 U | <1.7 U | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | <1.9 UM-03 | <1.9 U | <1.9 U | <18 U | <1.9 U | <1.7 U | <1.7 U | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **44** | <500 U | **33** | **21** | **19** | **23** | **25** | **30** | **29** | **4.2** | **5.0** |
| Perfluorobutanoic acid (PFBA) | ng/l | **62** | <500 U | **71** | **54** | **57** | **45 M-03** | **54** | **39 M-03** | **39** | **11** | **7.5** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <3.5 UQ | <500 U | <0.93 U | <0.96 U | <0.96 U | <9.2 U | <0.96 U | <0.87 U | <0.87 U | <4.2 U | <4.2 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <3.5 U | <500 U | **0.34 JM-03** | <0.96 U | <0.96 U | <9.2 U | **0.32 JM-03** | **0.52 JM-03** | **0.36 JM-03** | <4.2 U | <4.2 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | <0.93 U | <0.96 U | <0.96 U | <9.2 U | <0.96 U | <0.87 U | <0.87 U | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <3.5 U | <500 U | <0.93 U | <0.96 U | <0.96 U | <9.2 U | <0.96 U | <0.87 U | <0.87 U | <4.2 U | <4.2 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **140** | **130 J** | **300** | **280 M-03** | **280** | **180** | **270** | **310** | **300** | **7.8** | **6.6** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **150** | **140 J** | **160** | **180** | **160** | **140** | **150** | **94** | **90** | **33** | **12** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **1900** | **2100** | **2500 H** | **2400** | **2700 M-03** | **2200 M-03** | **2100** | **2100 M-03** | **2200 M-03** | **200** | **130** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **310** | **260 J** | **300** | **220** | **230** | **220 M-03** | **230** | **210** | **210 M-03** | **26** | **10** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <3.5 UQ | <500 U | **1.8 M-03** | **0.88 JM-03** | **0.87 JM-03** | <9.2 U | **1.4 M-03** | **1.4 M-03** | **1.5 M-03** | <4.2 U | <4.2 U |
| Perfluorononanoic acid (PFNA) | ng/l | **76 Q** | <500 U | **73 M-03** | **89 M-03** | **98 M-03** | **88 M-03** | **96 M-03** | **94 M-03** | **100 M-03** | **8.0** | **3.1 J** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | **1.0 J** | <500 U | <50 UH | **4.6 M-03** | **4.7 M-03** | **4.1 JM-03** | **4.7 M-03** | **5.5 M-03** | **5.4 M-03** | <4.2 U | <4.2 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **16000** | **23000** | **26000 HM-03** | **27000 HM-03** | **27000 HM-03** | **22000 BHSM-03** | **23000 HM-03** | **20000 HM-03** | **23000 HM-03** | **1000** | **680** |
| Perfluorooctanoic acid (PFOA) | ng/l | **230** | **260 J** | **260** | **270 M-03** | **280 M-03** | **270 M-03** | **300** | **220 M-03** | **220 M-03** | **26** | **19** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **89** | <500 U | **110** | **67** | **69** | **53** | **71** | **75** | **75** | **7.3** | **6.4** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **150 B** | <500 U | **160** | **130** | **130** | **120 M-03** | **130** | **88 M-03** | **88 M-03** | **19** | **8.3** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <3.5 UQ | <500 U | <0.93 U | <0.96 U | <100 UH | <100 UH | <0.96 U | <0.87 U | <0.87 U | <4.2 U | <4.2 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <3.5 U | <500 U | <0.93 U | <0.96 U | <0.96 U | <9.2 U | <0.96 U | <0.87 U | <0.87 U | <4.2 U | <4.2 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <3.5 U | <500 U | <0.93 U | <0.96 U | <0.96 U | <9.2 U | <0.96 U | <0.87 U | <0.87 U | <4.2 U | <4.2 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

**Table 13**
**PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs**
**ESTCP Final Report**
**Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge**
**Grayling, Michigan**

| Location | | VRTB-S-S2 | VRTB-S-S2 | VRTB-S-S2 | VRTB-S-S2 | VRTB-S-S2 | VRTB-S-S2 | VRTB-S-Y3 | VRTB-S-Y3 | VRTB-S-Y3 | VRTB-S-Y3 | VRTB-S-Y3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow | Shallow |
| Sample Date | | 6/13/2022 | 8/22/2022 | 10/24/2023 | 1/23/2024 | 4/3/2024 | 7/15/2024 | 12/23/2021 | 4/14/2022 | 6/13/2022 | 8/23/2022 | 10/24/2023 |
| Analyte | Units | | | | | | | | | | | |
| **PFAS** | | | | | | | | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- | -- | -- | -- | <8.2 U | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | -- | -- | <3.9 U | <3.9 U | <3.6 U | <3.5 U | -- | -- | -- | -- | <5.4 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | -- | -- | <3.9 U | <3.9 U | <3.6 U | <3.5 U | -- | <8.2 U | -- | -- | <5.4 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | -- | -- | <24 U | <24 U | <22 U | <22 U | -- | -- | -- | -- | <34 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | -- | -- | <4.9 U | <4.9 U | <4.5 U | <4.4 U | -- | -- | -- | -- | <6.8 U |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | -- | -- | <24 U | <24 U | <22 U | <22 U | -- | -- | -- | -- | <34 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | -- | -- | <3.9 U | <3.9 U | <3.6 U | <3.5 U | -- | -- | -- | -- | <5.4 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <7.0 U | <6.9 U | <3.9 U | <3.9 U | <3.6 U | <3.5 U | <7.9 U | <8.2 U | <6.8 U | <11 U | <5.4 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <7.0 U | <6.9 U | **2.4 JM-03** | <4.9 U | <4.5 U | <4.4 U | <7.9 U | <8.2 U | <6.8 U | <11 U | <6.8 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <7.0 U | <6.9 U | **0.61 J** | <3.9 UL | **0.61 JM-03** | <3.5 U | **6.5 J** | **4.0 J** | **2.0 J** | **2.7 J** | **2.7 JM-03** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | -- | -- | <3.9 U | <3.9 U | <3.6 U | <3.5 U | -- | -- | -- | -- | <5.4 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | <0.98 U | <0.98 U | <0.89 U | <0.88 U | -- | <8.2 U | -- | -- | <1.4 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | <9.8 U | <50 UHL | <8.9 U | <8.8 U | -- | -- | -- | -- | <14 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <7.0 U | <6.9 U | <0.98 U | <0.98 U | <0.89 U | <0.88 U | <7.9 U | <8.2 U | <6.8 U | <11 U | <1.4 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <14 U | <14 U | <0.98 U | <0.98 U | <0.89 U | <0.88 U | <16 U | <16 U | <14 U | <22 U | <1.4 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | <9.8 U | <50 UHL | <8.9 U | <8.8 U | -- | -- | -- | -- | <14 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <7.0 U | <6.9 U | <0.98 U | <0.98 U | <0.89 U | <0.88 U | <7.9 U | <8.2 U | <6.8 U | <11 U | <1.4 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | <2 U | <2 U | <1.8 U | <1.8 U | -- | -- | -- | -- | <2.7 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | <2 U | <2 U | <1.8 U | <1.8 U | -- | -- | -- | -- | <2.7 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | <2 U | <2 U | <1.8 U | <1.8 U | -- | -- | -- | -- | <2.7 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | <2 U | <2 U | <1.8 U | <1.8 U | -- | -- | -- | -- | <2.7 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **5.8** | **4.2** | **4.7** | **6.5** | **6.6** | **5.2 M-03** | **10** | **8.9** | **5.9** | **9.4** | **7.6** |
| Perfluorobutanoic acid (PFBA) | ng/l | **7.2** | **15** | **16** | **19** | **16** | **19 M-03** | **8.4** | **10** | **8.1** | **12** | **13** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <3.5 U | <3.5 U | <0.98 U | <0.98 U | <0.89 U | <0.88 U | <4.0 U | <4.1 U | <3.4 U | <5.4 U | <1.4 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <3.5 U | <3.5 U | <0.98 U | <0.98 U | <0.89 U | <0.88 U | <4.0 U | <4.1 U | <3.4 U | <5.4 U | <1.4 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | <0.98 U | <0.98 U | <0.89 U | <0.88 U | -- | -- | -- | -- | <1.4 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <3.5 U | <3.5 U | <0.98 U | <0.98 U | <0.89 U | <0.88 U | <4.0 U | <4.1 U | <3.4 U | <5.4 U | <1.4 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **6.5** | **7.5** | **11** | **14 M-03** | **10** | **9.7 M-03** | **20** | **18** | **19** | **27** | **36** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **17** | **25** | **29** | **28** | **23** | **37** | **15** | **14** | **9.9** | **15** | **14** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **140** | **160** | **150 M-03** | **180** | **160 M-03** | **120** | **490** | **410** | **320** | **610** | **570 M-03** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **12** | **22** | **27** | **23 M-03** | **24** | **35** | **31** | **28** | **20** | **33** | **32** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <3.5 U | <3.5 U | **0.44 JM-03** | <0.98 U | **0.31 JM-03** | **0.32 JM-03** | <4.0 U | <4.1 U | <3.4 U | <5.4 U | **0.42 JM-03** |
| Perfluorononanoic acid (PFNA) | ng/l | **4.9** | **7.7** | **21 M-03** | **25 M-03** | **20** | **20** | **4.5** | **3.6 J** | **4.0** | **6.7** | **5.9 M-03** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | **0.89 J** | **3.0 J** | **1.1 M-03** | <0.98 U | **0.86 JM-03** | **1.2 M-03** | <4.0 U | <4.1 U | **1.1 J** | **3.8 J** | **2.2 M-03** |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **680** | **870** | **770 M-03** | **830 M-03** | **650 M-03** | **750 M-03** | **1500** | **1200** | **1200** | **1600** | **1600 M-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **20** | **44** | **46 M-03** | **38 M-03** | **39 M-03** | **36 M-03** | **18** | **19** | **14** | **28** | **25 M-03** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **7.2** | **6.7** | **7.4** | **8** | **7.7** | **6.9** | **27** | **19** | **12** | **19** | **17** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **9.5** | **16** | **25** | **29** | **25 M-03** | **31 M-03** | **15** | **17** | **12** | **19** | **21** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <3.5 U | <3.5 U | <0.98 U | <5 UHL | <0.89 U | <0.88 U | <4.0 U | <4.1 U | <17 U | <5.4 U | <1.4 UQ |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <3.5 U | <3.5 U | <0.98 U | <0.98 U | <0.89 U | <0.88 U | <4.0 U | <4.1 U | <3.4 U | <5.4 U | <1.4 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <3.5 U | <3.5 U | <0.98 U | <0.98 U | <0.89 U | <0.88 U | <4.0 U | <4.1 U | <3.4 U | <5.4 U | <1.4 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

**Table 13**
**PFAS Groundwater Analytical Results - Monitoring Wells, MLS, and VWSs**
**ESTCP Final Report**
**Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge**
**Grayling, Michigan**

| | Location | VRTB-S-Y3 | VRTB-S-Y3 | VRTB-S-Y3 |
|---|---|---|---|---|
| | Depth Interval (ft bgs) | Shallow | Shallow | Shallow |
| | Sample Date | 1/23/2024 | 4/3/2024 | 7/15/2024 |
| **Analyte** | **Units** | | | |
| **PFAS** | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <20 U | <3.7 U | <3.5 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <20 U | <3.7 U | <3.5 U |
| 2H, 2H, 3H, 3H-perfluorodecanoic acid (7:3 FTCA) | ng/l | <130 U | <23 U | <22 U |
| 2H, 2H, 3H, 3H-perfluorohexanoic acid | ng/l | <25 U | <4.6 U | <4.4 U |
| 2H, 2H, 3H, 3H-perfluorooctanoic acid (5:3 FTCA) | ng/l | <130 U | <23 U | <22 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <20 U | <3.7 U | <3.5 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <20 U | <3.7 U | <3.5 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <25 U | <4.6 U | <4.4 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <20 UL | **3.8 M-03** | **1.9 JM-03** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <20 U | <3.7 U | <3.5 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | <5 U | <0.92 U | <0.89 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <50 U | <9.2 U | <8.9 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <5 U | <0.92 U | <0.89 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <5 U | <0.92 U | <0.89 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <50 U | <9.2 U | <8.9 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <5 U | <0.92 U | <0.89 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <10 U | <1.8 U | <1.8 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <10 U | <1.8 U | <1.8 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <10 U | <1.8 U | <1.8 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <10 U | <1.8 U | <1.8 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **6.6** | **7.6 M-03** | **10** |
| Perfluorobutanoic acid (PFBA) | ng/l | **13 J** | **14 M-03** | **16** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <5 U | <0.92 U | <0.89 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <5 U | <0.92 U | <0.89 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <5 U | <0.92 U | <0.89 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <5 U | <0.92 U | <0.89 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **35 M-03** | **32** | **29** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **15** | **12** | **15** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **530 M-03** | **450 M-03** | **610 M-03** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **25 M-03** | **30** | **37** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <5 U | <0.92 U | **0.39 JM-03** |
| Perfluorononanoic acid (PFNA) | ng/l | **3.9 JM-03** | **5.5 M-03** | **4.9 M-03** |
| Perfluorooctane sulfonamide (PFOSA) | ng/l | <5 U | **1.5 M-03** | **1.5 M-03** |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **1300 M-03** | **1100 M-03** | **1100 BM-03** |
| Perfluorooctanoic acid (PFOA) | ng/l | **28** | **23 M-03** | **26** |
| Perfluoropentane sulfonate (PFPeS) | ng/l | **13** | **12 M-03** | **26** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **16** | **21** | **25 M-03** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <5 U | <0.92 U | <0.89 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <5 U | <0.92 U | <0.89 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <5 U | <0.92 U | <0.89 U |

**Notes:**
1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

**Abbreviations:**
FD = Field Duplicate Sample
ft bgs - feet below ground surface
ID - Identification
N = Normal Field Sample
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances
SU - standard unit
-- Not analyzed

**Qualifiers:**
B - Detected in the method blank
H - Out of holding time
J - estimated value between the limit of quantitation and the method detection limit.
L - LCS/LCSD failure
M - Manual integration occurred due to incorrect auto integration
Q - Indicates a non-compliant QC Result (see Q flag application report: surrogate failure)
S - Indicates a non-compliant QC Result (see Q flag application report: MS/MSD failure)
U - Not detected at or above the limit of quantitation

**Table 14**
**PFAS Top Assay Groundwater Analytical Results - MLS and VWS**
**ESTCP Final Report**
**Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge**
**Grayling, Michigan**

| | Location | CMT-VRTB-01_1 | CMT-VRTB-01_1 | CMT-VRTB-01_2 | CMT-VRTB-01_2 |
|---|---|---|---|---|---|
| | Depth Interval (ft bgs) | 15 | 15 | 17 | 17 |
| | Sample Date | 4/15/2022 | 6/15/2022 | 4/15/2022 | 8/25/2022 |
| Analyte | Units | | | | |
| **PFAS Top Assay (Pre)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | <10.0 U | -- | <10000 U |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <50.0 U | <50.0 U | <50.0 U | <50000 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <10.0 U | <10.0 U | **90.2** | <10000 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <10.0 U | <10.0 U | **24.4** | <10000 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | <20.0 U | -- | <20000 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | <20.0 U | -- | <20000 UQ |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20000 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | -- | <20.0 U | -- | <20000 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | <20.0 U | -- | <20000 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20000 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | <10.0 U | -- | <10000 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | <10.0 U | -- | <10000 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | <10.0 U | -- | <10000 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | <10.0 U | -- | <10000 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **68.0** | **6.56 J** | **23.7** | <10000 U |
| Perfluorobutanoic acid (PFBA) | ng/l | **34.4** | **13.1** | **32.9** | <10000 U |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | <10.0 U | -- | <10000 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **10.1** | **5.97 J** | **112** | <10000 U |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **78.0** | **81.5** | **105** | <10000 U |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **38.1** | **58.1** | **2130** | **6400 J** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **62.2** | **32.7** | **183** | <10000 U |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluorononanoic acid (PFNA) | ng/l | <10.0 U | <10.0 U | **62.7** | <10000 U |
| Perfluorooctadecanoic acid (PFODA) | ng/l | -- | <10.0 U | -- | <10000 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **190** | **243** | **22500** | **64200** |
| Perfluorooctanoic acid (PFOA) | ng/l | -- | -- | **194** | -- |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | <10.0 U | **2.72 J** | **59.8** | <10000 U |
| Perfluoropentanoic acid (PFPeA) | ng/l | **82.2** | **40.5** | **85.3** | <10000 U |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| **PFAS Top Assay (Post)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | <10.0 U | -- | <10000 U |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <50.0 U | <50.0 U | <50.0 U | <50000 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | <20.0 U | -- | <20000 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | <20.0 U | -- | <20000 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20000 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | -- | <20.0 U | -- | <20000 UQ |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | <20.0 U | -- | <20000 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20000 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | <10.0 U | -- | <10000 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | <10.0 U | -- | <10000 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | <10.0 U | -- | <10000 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | <10.0 U | -- | <10000 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **76.6** | **5.62 J** | **25.1** | <10000 U |
| Perfluorobutanoic acid (PFBA) | ng/l | **40.9** | **15.8** | **299** | <10000 U |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | <10.0 U | -- | <10000 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **11.1** | **5.58 J** | **121** | <10000 U |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **88.2** | **75.4** | **199** | <10000 U |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **42.7** | **52.3** | **2450** | **6380 J** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **126** | **74.8** | **4400** | **11300** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluorononanoic acid (PFNA) | ng/l | <10.0 U | <10.0 U | **56.7** | <10000 U |
| Perfluorooctadecanoic acid (PFODA) | ng/l | -- | <10.0 U | -- | <10000 UQ |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **204** | **171** | **20500** | **57100** |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | <10.0 U | <10.0 U | **66.9** | <10000 U |
| Perfluoropentanoic acid (PFPeA) | ng/l | **101** | **48.7** | **976** | **3450 J** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10000 U |

**Notes:**

1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

2. Samples from performance monitoring event #2 were oxidized twice as a QC check by the lab, resulting in two Post analysis results (Post and Post-2)

**Abbreviations:**

ft bgs - feet below ground surface
ID - Identification
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances

**Qualifiers:**
J - estimated value between the limit of quantitation and the method detection limit.
U - Not detected at or above the limit of quantitation.

**Table 14**
**PFAS Top Assay Groundwater Analytical Results - MLS and VWS**
**ESTCP Final Report**
**Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge**
**Grayling, Michigan**

| | Location | CMT-VRTB-01_3 | CMT-VRTB-01_3 | CMT-VRTB-01_4 | CMT-VRTB-01_5 |
|---|---|---|---|---|---|
| | Depth Interval (ft bgs) | 19.5 | 19.5 | 23 | 26.5 |
| | Sample Date | 4/15/2022 | 8/25/2022 | 4/15/2022 | 4/15/2022 |
| Analyte | Units | | | | |
| **PFAS Top Assay (Pre)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | <10.0 U | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <50.0 U | <20.0 U | <50.0 U | <50.0 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | **9.85 J** | **24.9** | <10.0 U | <10.0 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **6.94 J** | **11.0** | <10.0 U | <10.0 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | <20.0 U | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | <20.0 U | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | -- | <20.0 U | -- | -- |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | <20.0 U | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | <10.0 U | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | <10.0 U | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | <10.0 U | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | <10.0 U | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **7.47 J** | **10.7** | **8.38 J** | **8.13 J** |
| Perfluorobutanoic acid (PFBA) | ng/l | **14.3** | **12.5** | **13.4** | **11.7** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | <10.0 U | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **10.5** | **21.0** | **5.83 J** | **3.53 J** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **16.1** | **25.3** | **11.7** | **9.86 J** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **231** | **453** | **139** | **113** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **26.1** | **25.1** | **20.7** | **18.7** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | **9.49 J** | **17.4** | **3.57 J** | <10.0 U |
| Perfluorooctadecanoic acid (PFODA) | ng/l | -- | <10.0 U | -- | -- |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **1830** | **2730** | **528** | **84.6** |
| Perfluorooctanoic acid (PFOA) | ng/l | -- | -- | -- | -- |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | **10.4** | **14.0** | **10.5** | **10.5** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **22.2** | **19.9** | **18.6** | **16.5** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| **PFAS Top Assay (Post)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | <10.0 U | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <50.0 U | <20.0 U | <50.0 U | <50.0 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| N-Ethyl perfluorooctane sulfonamide (N-EtFOSA) | ng/l | -- | <20.0 U | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | <20.0 U | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | -- | <20.0 U | -- | -- |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | <20.0 U | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | <10.0 U | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | <10.0 U | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | <10.0 U | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | <10.0 U | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **6.74 J** | **8.60 J** | **7.71 J** | **7.44 J** |
| Perfluorobutanoic acid (PFBA) | ng/l | **53.1** | **60.2** | **62.8** | **61.8** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | <10.0 U | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **9.77 J** | **17.0** | **5.60 J** | **3.06 J** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **21.4** | **29.6** | **13.4** | **10.5** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **235** | **400** | **143** | **114** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **295** | **419** | **98.4** | **42.1** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | **9.03 J** | **13.3** | **3.82 J** | <10.0 U |
| Perfluorooctadecanoic acid (PFODA) | ng/l | -- | <10.0 U | -- | -- |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **1830** | **2180** | **540** | **84.9** |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | **10.6** | **11.4** | **11.2** | **10.0** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **81.1** | **98.1** | **52.0** | **42.9** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |

**Notes:**

1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

2. Samples from performance monitoring event #2 were oxidized twice as a QC check by the lab, resulting in two Post analysis results (Post and Post-2)

**Abbreviations:**

ft bgs - feet below ground surface
ID - Identification
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances

**Qualifiers:**
J - estimated value between the limit of quantitation and the method detection limit.
U - Not detected at or above the limit of quantitation.

**Table 14**
**PFAS Top Assay Groundwater Analytical Results - MLS and VWS**
**ESTCP Final Report**
**Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge**
**Grayling, Michigan**

| | Location | CMT-VRTB-01_6 | CMT-VRTB-01_7 | CMT-VRTB-01-1 | CMT-VRTB-01-2 |
|---|---|---|---|---|---|
| | Depth Interval (ft bgs) | 30.5 | 36.5 | 15 | 17 |
| | Sample Date | 4/15/2022 | 4/15/2022 | 12/17/2021 | 12/17/2021 |
| Analyte | Units | | | | |
| **PFAS Top Assay (Pre)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <50.0 U | <50.0 U | <50.0 U | <50.0 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <10.0 U | <10.0 U | **18.7** | **57.2** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | **34.2** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| N-Ethyl perfluoroctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | -- | -- | -- | -- |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **8.43 J** | **1.83 J** | **57.6** | **14.5** |
| Perfluorobutanoic acid (PFBA) | ng/l | **16.3** | <10.0 U | **30.8** | **42.7** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **4.27 J** | <10.0 U | **38.8** | **77.8** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **8.59 J** | <10.0 U | **108** | **132** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **128** | **23.9** | **1190** | **1690** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **21.8** | <10.0 U | **139** | **158** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | <10.0 U | <10.0 U | **16.1** | **58.0** |
| Perfluorooctadecanoic acid (PFODA) | ng/l | -- | -- | -- | -- |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **76.9** | **9.01 J** | **4950** | **19700** |
| Perfluorooctanoic acid (PFOA) | ng/l | -- | -- | -- | -- |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | **11.2** | <10.0 U | **39.3** | **32.3** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **19.2** | <10.0 U | **74.2** | **116** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| **PFAS Top Assay (Post)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <50.0 U | <50.0 U | <50.0 U | <50.0 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | **5.50 J** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | **3.06 J** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| N-Ethyl perfluoroctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | -- | -- | -- | -- |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **7.32 J** | <10.0 U | **63.2** | **13.0** |
| Perfluorobutanoic acid (PFBA) | ng/l | **68.5** | <10.0 U | **103** | **178** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **3.98 J** | <10.0 U | **39.4** | **62.5** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **8.81 J** | <10.0 U | **150** | **162** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **131** | **24.9** | **1320** | **1530** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **68.8** | **5.34 J** | **2100** | **3370** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | <10.0 U | <10.0 U | **12.9** | **40.1** |
| Perfluorooctadecanoic acid (PFODA) | ng/l | -- | -- | -- | -- |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **74.8** | **7.15 J** | **3620** | **13400** |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | **10.7** | <10.0 U | **46.5** | **31.2** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **63.9** | **3.02 J** | **541** | **835** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |

**Notes:**

1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

2. Samples from performance monitoring event #2 were oxidized twice as a QC check by the lab, resulting in two Post analysis results (Post and Post-2)

**Abbreviations:**

ft bgs - feet below ground surface
ID - Identification
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances

**Qualifiers:**
J - estimated value between the limit of quantitation and the method detection limit.
U - Not detected at or above the limit of quantitation.

**Table 14**
**PFAS Top Assay Groundwater Analytical Results - MLS and VWS**
**ESTCP Final Report**
**Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge**
**Grayling, Michigan**

| Location | | CMT-VRTB-01-3 | CMT-VRTB-01-4 | CMT-VRTB-01-5 | CMT-VRTB-01-6 |
|---|---|---|---|---|---|
| Depth Interval (ft bgs) | | 19.5 | 23 | 26.5 | 30.5 |
| Sample Date | | 12/17/2021 | 12/17/2021 | 12/17/2021 | 12/17/2021 |
| **Analyte** | **Units** | | | | |
| **PFAS Top Assay (Pre)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <50.0 U | <50.0 U | <50.0 U | <50.0 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| N-Ethyl perfluoroctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | -- | -- | -- | -- |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **8.71 J** | **8.03 J** | **7.70 J** | **9.45 J** |
| Perfluorobutanoic acid (PFBA) | ng/l | **13.3** | **35.8** | **8.06 J** | **8.74 J** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **13.4** | **4.83 J** | **3.94 J** | **3.29 J** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **19.6** | **20.2** | **8.97 J** | **6.73 J** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **231** | **90.9** | **95.4** | **122** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **23.3** | **28.6** | **13.7** | **15.7** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | **13.9** | **4.29 J** | <10.0 U | <10.0 U |
| Perfluorooctadecanoic acid (PFODA) | ng/l | -- | -- | -- | -- |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **2850** | **578** | **102** | **59.1** |
| Perfluorooctanoic acid (PFOA) | ng/l | -- | -- | -- | -- |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | **9.97 J** | **7.14 J** | **9.21 J** | **10.9** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **22.9** | **62.4** | **12.9** | **11.0** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| **PFAS Top Assay (Post)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | -- | -- | -- |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <50.0 U | <50.0 U | <50.0 U | <50.0 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| N-Ethyl perfluoroctane sulfonamide (N-EtFOSA) | ng/l | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | -- | -- | -- |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | -- | -- | -- | -- |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | -- | -- | -- |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | -- | -- | -- |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | -- | -- | -- |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | -- | -- | -- |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | -- | -- | -- |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **8.34 J** | **8.18 J** | **7.98 J** | **10.5** |
| Perfluorobutanoic acid (PFBA) | ng/l | **32.4** | **26.3** | **44.5** | **48.1** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | -- | -- | -- |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **10.9** | **3.83 J** | <10.0 U | <10.0 U |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **21.8** | **10.9** | **7.80 J** | **5.56 J** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **206** | **80.7** | **77.8** | **95.2** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **363** | **70.3** | **40.6** | **54.9** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | **10.3** | <10.0 U | <10.0 U | <10.0 U |
| Perfluorooctadecanoic acid (PFODA) | ng/l | -- | -- | -- | -- |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **2020** | **407** | **63.7** | **39.4** |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | **10.1** | **7.72 J** | **8.65 J** | **11.4** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **101** | **39.4** | **38.3** | **49.4** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |

**Notes:**

1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

2. Samples from performance monitoring event #2 were oxidized twice as a QC check by the lab, resulting in two Post analysis results (Post and Post-2)

**Abbreviations:**

ft bgs - feet below ground surface
ID - Identification
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances

**Qualifiers:**
J - estimated value between the limit of quantitation and the method detection limit.
U - Not detected at or above the limit of quantitation.

**Table 14**
**PFAS Top Assay Groundwater Analytical Results - MLS and VWS**
**ESTCP Final Report**
**Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge**
**Grayling, Michigan**

| | Location | CMT-VRTB-01-7 | VRTB-L-B1 | VRTB-L-BB8 | VRTB-L-G4 |
|---|---|---|---|---|---|
| | Depth Interval (ft bgs) | 36.5 | Longsect | Longsect | Longsect |
| | Sample Date | 12/17/2021 | 8/23/2022 | 8/23/2022 | 8/23/2022 |
| Analyte | Units | | | | |
| **PFAS Top Assay (Pre)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <50.0 U | <20.0 U | <20.0 U | <20.0 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <10.0 U | <10.0 U | **73.6** | **79.7** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <10.0 U | **4.06 J** | **20.5** | **39.4** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| N-Ethyl perfluoroctane sulfonamide (N-EtFOSA) | ng/l | -- | <20.0 U | <20.0 U | <20.0 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | <20.0 U | <20.0 U | <20.0 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | -- | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | <20.0 U | <20.0 U | <20.0 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | <10.0 U | **9.14 J** | **23.7** | **8.47 J** |
| Perfluorobutanoic acid (PFBA) | ng/l | <10.0 U | **9.03 J** | **58.9** | **34.7** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | <10.0 U | **13.7** | **68.6** | **47.1** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | <10.0 U | **11.0** | **140** | **126** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **13.1** | **196** | **1780** | **1800** |
| Perfluorohexanoic acid (PFHxA) | ng/l | <10.0 U | **19.3** | **222** | **104** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | <10.0 U | **6.05 J** | **46.4** | **22.0** |
| Perfluorooctadecanoic acid (PFODA) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **7.31 J** | **885** | **9090** | **2520** |
| Perfluorooctanoic acid (PFOA) | ng/l | -- | -- | -- | -- |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | <10.0 U | **14.9** | **55.5** | **29.2** |
| Perfluoropentanoic acid (PFPeA) | ng/l | <10.0 U | **13.8** | **159** | **61.8** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| **PFAS Top Assay (Post)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <50.0 U | <20.0 U | <20.0 U | <20.0 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| N-Ethyl perfluoroctane sulfonamide (N-EtFOSA) | ng/l | -- | <20.0 U | <20.0 U | <20.0 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | -- | <20.0 U | <20.0 U | <20.0 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | -- | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | -- | <20.0 U | <20.0 U | <20.0 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | <10.0 U | **10.6** | **25.5** | **7.90 J** |
| Perfluorobutanoic acid (PFBA) | ng/l | <10.0 U | **52.5** | **212** | **120** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | <10.0 U | **11.7** | **63.4** | **42.2** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | <10.0 U | **12.4** | **183** | **144** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **11.6** | **187** | **1810** | **1630** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **2.51 J** | **147** | **2120** | **1130** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | <10.0 U | **5.67 J** | **44.8** | **20.6** |
| Perfluorooctadecanoic acid (PFODA) | ng/l | -- | <10.0 U | <10.0 U | <10.0 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **5.79 J** | **798** | **9030** | **2380** |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | <10.0 U | **15.6** | **67.4** | **28.5** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **2.61 J** | **54.9** | **571** | **275** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |

**Notes:**

1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

2. Samples from performance monitoring event #2 were oxidized twice as a QC check by the lab, resulting in two Post analysis results (Post and Post-2)

**Abbreviations:**

ft bgs - feet below ground surface
ID - Identification
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances

**Qualifiers:**
J - estimated value between the limit of quantitation and the method detection limit.
U - Not detected at or above the limit of quantitation.

**Table 14**
**PFAS Top Assay Groundwater Analytical Results - MLS and VWS**
**ESTCP Final Report**
**Vertebrae Segmented Horizontal Wells for Monitoring PFAS Mass Discharge**
**Grayling, Michigan**

| | Location | VRTB-L-M5 | VRTB-L-P7 | VRTB-L-S2 | VRTB-L-Y3 |
|---|---|---|---|---|---|
| | Depth Interval (ft bgs) | Longsect | Longsect | Longsect | Longsect |
| | Sample Date | 8/23/2022 | 8/23/2022 | 8/23/2022 | 8/23/2022 |
| **Analyte** | **Units** | | | | |
| **PFAS Top Assay (Pre)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | **171** | **87.7** | **26.1** | **63.5** |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | **44.9** | **48.3** | **43.5** | **113** |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| N-Ethyl perfluoroctane sulfonamide (N-EtFOSA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **15.0** | **10.5** | **9.45 J** | **5.60 J** |
| Perfluorobutanoic acid (PFBA) | ng/l | **46.5** | **48.3** | **11.7** | **10.3** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **75.5** | **70.6** | **21.8** | **42.0** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **141** | **117** | **21.6** | **34.7** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **1720** | **928** | **382** | **611** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **170** | **128** | **27.2** | **27.1** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | **68.8** | **57.9** | **18.7** | **53.3** |
| Perfluorooctadecanoic acid (PFODA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **13400** | **18700** | **2920** | **11200** |
| Perfluorooctanoic acid (PFOA) | ng/l | -- | -- | -- | -- |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | **42.5** | **21.5** | **16.3** | **10.4** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **114** | **122** | **16.7** | **19.6** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| **PFAS Top Assay (Post)** | | | | | |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| 4,8-Dioxa-3H-perfluorononanoic acid (DONA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 4:2 Fluorotelomer sulfonate (4:2 FTS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CL-PF3ONS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| N-Ethyl perfluoroctane sulfonamide (N-EtFOSA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Ethyl perfluorooctane sulfonamide ethanol (N-EtFOSE) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamide (N-MeFOSA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methyl perfluorooctane sulfonamidoethanol (N-MeFOSE) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA) | ng/l | <20.0 U | <20.0 U | <20.0 U | <20.0 U |
| Nonafluoro-3,6-Dioxaheptonic Acid (NFDHA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro (2-Ethoxyethane) Sulfonic Acid (PFEESA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro-3-methoxypropanoic aci (PFMPA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoro-4-Methoxybutanic acid (PFMBA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorobutane sulfonic acid (PFBS) | ng/l | **14.2** | **11.7** | **8.02 J** | **4.61 J** |
| Perfluorobutanoic acid (PFBA) | ng/l | **172** | **183** | **96.0** | **95.0** |
| Perfluorodecane sulfonic acid (PFDS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorodecanoic acid (PFDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecane sulfonic acid (PFDOS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorododecanoic acid (PFDoA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroheptane sulfonic acid (PFHpS) | ng/l | **57.8** | **58.7** | **18.2** | **35.6** |
| Perfluoroheptanoic acid (PFHpA) | ng/l | **177** | **148** | **39.3** | **87.7** |
| Perfluorohexane sulfonic acid (PFHxS) | ng/l | **1470** | **915** | **333** | **570** |
| Perfluorohexanoic acid (PFHxA) | ng/l | **1800** | **1310** | **942** | **2160** |
| Perfluorononane sulfonic acid (PFNS) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorononanoic acid (PFNA) | ng/l | **52.7** | **49.8** | **16.0** | **47.1** |
| Perfluorooctadecanoic acid (PFODA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorooctane sulfonic acid (PFOS) | ng/l | **9450** | **15100** | **2590** | **9630** |
| Perfluoropentane sulfonic acid (PFPeSA) | ng/l | **41.9** | **25.1** | **13.2** | **10.0** |
| Perfluoropentanoic acid (PFPeA) | ng/l | **468** | **405** | **227** | **323** |
| Perfluorotetradecanoic acid (PFTeDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluorotridecanoic acid (PFTrDA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |
| Perfluoroundecanoic acid (PFUdA) | ng/l | <10.0 U | <10.0 U | <10.0 U | <10.0 U |

**Notes:**

1. Bold indicates that sample results were reported above the laboratory reporting detection limit of detection.

2. Samples from performance monitoring event #2 were oxidized twice as a QC check by the lab, resulting in two Post analysis results (Post and Post-2)

**Abbreviations:**

ft bgs - feet below ground surface
ID - Identification
ng/L - nanograms per liter
PFAS - per- and polyfluoroalkyl substances

**Qualifiers:**
J - estimated value between the limit of quantitation and the method detection limit.
U - Not detected at or above the limit of quantitation.

### 5.6.2 VWS Hydraulic and Tracer Testing

Hydraulic testing was completed for VWS well screens to estimate groundwater flux and local K values. Individual isolated horizontal well screens within the shallow (B1, S2, Y3, G4, M5, O6, R7, and P8) and deep (B1, S2, Y3, G4, M5, O6, R7, and P8) VWS transects were tested using the inflow (falling head) method. Select deep VWS transect intervals (M5, O6, R7, and P8) were also tested using the pneumatic slug testing method. The VWS hydraulic testing results are provided in Appendix D. As discussed further in Section 7.2, it was concluded that skin effects were likely present, with slug testing results biased low and unreliable due to friction losses associated with the geotextile membrane used in the VWS construction. Therefore, estimating local K using VWS screens for slug testing is not recommended.

Point-dilution tracer tests were also completed at each VWS screen to provide local measures of the darcy flux. A TGI was previously developed and presented with the Go/No-Go Decision Recommendation (Divine et al. 2021b). The TGI provides detailed field procedures for performing single-well point dilution tracer tests specifically within a VWS. An Excel-based tracer test interpretation tool is also included as part of the TGI.

### 5.6.3 Active Fiber Optic Distributed Temperature Sensing Testing

Temperature data were collected using a four-channel Silixa ULTIMA-S™ DTS configured for a maximum fiber length of 1.8 kilometers. The A-DTS has sampling, spatial, and temporal resolutions of 0.125 meter, 0.29 meter, and +/- 0.01 °C, respectively. Data were collected using the internal double-ended calibration routine for slope correction, and a calibration bath with 45 feet of unheated cable and two PT100 temperature sensors for the offset calibration. Distributed temperature measurements along the full cable length were collected continuously throughout the A-DTS tests. This typically involved 30 minutes before heating to capture the background temperature profile, and an active heating phase at 10 watts per meter (W/m) for 24 hours.

An offset calibration is conducted after data collection and the data are averaged through time to reach a temperature resolution of approximately +/- 0.03 °C. The in-situ thermal conductivity is calculated from each depth using the rate of temperature increase (during the heating period) and the infinite line source analytical theory presented by Carslaw and Jaeger (1959). If the thermal conductivity of the surrounding aquifer material is known, the flux can be estimated from the A-DTS apparent thermal conductivity using the approach presented by Maldaner et al. (2019). This approach uses numerical modelling to develop an empirical relationship for a particular test geometry and parameters to quantify groundwater flow rates with modelling details provided below.

The A-DTS testing proposed in this project deviates from the fractured rock application presented in Maldaner et al. (2019); therefore, preliminary numerical modelling was conducted to assess the feasibility of measuring flux in the unconsolidated aquifer with A-DTS. The model scenario was developed using representative site parameters and filters to represent the spatial and temperature resolution of the A-DTS unit, and the results are presented in Divine et al. (2021b). In summary, three scenarios were simulated to assess the effect of groundwater flow on the apparent thermal conductivity that can be estimated from an A-DTS test. These scenarios include a saturated homogeneous porous medium with no groundwater flow, the same saturated homogeneous porous medium with groundwater flow, and a scenario with groundwater flow and a horizontal layer with a K of half an order of magnitude higher than the surrounding sediment.

The modelling results demonstrate that the changes in flow through layers with contrasting K expected at the GAAF are measurable with the A-DTS technique, suggesting a good possibility of being able to apply A-DTS at the GAAF to estimate groundwater flux.

#### *5.6.3.1 Numerical Modelling for Groundwater Flux Estimation*

As the approach presented by Maldaner et al. (2019) requires an empirical relationship using the site-specific and test parameters, additional modelling was needed to develop this relationship to estimate groundwater flux. This involved numerous A-DTS simulations under a wide range of groundwater flow rates using representative test geometry and physical parameters.

The numerical modelling is based on the finite element numerical model Heatflow-Smoker that represents 3-D groundwater flow and heat transport in a homogeneous and isotropic porous medium (Molson et al. 1992). For this project, the full 3D domain has dimensions of 4 x 4 x 4 meters, with a fiber optic cable discretized vertically in the center of the domain.

The physical and thermal parameters used in the numerical model are presented in Tables 15 and 16, below. The thermal conductivity values for the sediment were informed from the lab thermal conductivity measurements using a TEMPOS Thermal Properties Analyzer and SH-3 dual-needle probe. The sediment samples were taken from three vertical boreholes (SB02, SB03, and SB-04) and the samples were fully saturated before testing (Tables 17, 18, and 19, below). The remainder of the values were based on pre-existing field or lab measurements or reasonable literature values. The model parameters presented in Table 16, below, represent reasonable site parameters. The hydraulic gradient is fixed at 0.0023 and the flow rate is changed by varying the K from $1x10^{-5}$ to $1x10^{-3}$ meter per second (m/s). The initial and boundary temperatures are set to 10 °C, which represents the average ambient groundwater temperature measured at the GAAF.

**Table 15. Physical and Thermal Parameters Used in the Numerical Model**

| Model Component | K | Thermal Conductivity | Specific Heat Capacity | Density | Porosity |
|---|---|---|---|---|---|
| | [m/s] | [W/mK] | [J/kgK] | [kg/m$^3$] | [-] |
| Solids | $1x10^{-3}$ - $1x10^{-5}$ | 3.97 | 1,041 | 2,156 | 0.48 |
| Water | NA | 0.57 | 4,187 | 1,000 | NA |

**Notes:**
- = unitless
J/kgK = joule per kilogram kelvin
kg/m$^3$ = kilogram per cubic meter
NA = not applicable
W/mK = watt per meter kelvin

**Table 16. Model Parameters**

| Model Parameters | |
|---|---|
| Hydraulic gradient [meter per meter] | 0.0023 |
| Initial temperature [°C] | 10 |
| Temperature at boundary [°C] | 10 |
| Power input [W/m] | 10 |
| Heating duration [hours] | 24 |

**Table 17. Effective Thermal Conductivity Values from Laboratory Measurements on Samples from Borehole SB02**

| Borehole | Top Depth [feet] | Bottom Depth [feet] | Thermal Conductivity [W/mK] |
|---|---|---|---|
| SB 02 | 10 | 12 | 2.44 |
| SB 02 | 12 | 15 | 2.60 |
| SB 02 | 15 | 16.5 | 2.50 |
| SB 02 | 16.5 | 18 | 2.46 |
| SB 02 | 18 | 22.3 | 2.20 |
| SB 02 | 22.3 | 22.5 | 2.42 |
| SB 02 | 22.5 | 25 | 2.51 |
| SB 02 | 25 | 27 | 2.51 |
| SB 02 | 27 | 30 | 2.54 |
| SB 02 | 30 | 32 | 2.43 |
| SB 02 | 32 | 34 | 2.53 |
| SB 02 | 34 | 35 | 2.44 |
| SB 02 | 35 | 38.5 | 2.43 |
| SB 02 | 38.5 | 39 | 2.53 |
| SB 02 | 38.5 | 39 | 2.54 |
| SB 02 | 39 | 40 | 2.50 |
| | | Minimum | 2.20 |
| | | Maximum | 2.60 |
| | | Average | 2.47 |
| | | Median | 2.50 |

**Table 18. Effective Thermal Conductivity Values from Laboratory Measurements on Samples from Borehole SB03**

| Borehole | Top Depth [feet] | Bottom Depth [feet] | Thermal Conductivity [W/mK] |
|---|---|---|---|
| SB 03 | 8 | 9.5 | 2.39 |
| SB 03 | 10 | 11 | 2.67 |
| SB 03 | 11 | 11.5 | 2.46 |
| SB 03 | 11.5 | 12 | 2.71 |
| SB 03 | 12 | 12.5 | 2.28 |
| SB 03 | 12.5 | 13 | 2.82 |
| SB 03 | 13 | 13.5 | 2.80 |
| SB 03 | 13.5 | 14 | 2.83 |
| SB 03 | 14.5 | 15 | 2.76 |
| SB 03 | 15 | 15.5 | 2.47 |
| SB 03 | 15.5 | 16 | 2.52 |
| SB 03 | 16 | 16.5 | 2.51 |

**Table 18. Effective Thermal Conductivity Values from Laboratory Measurements on Samples from Borehole SB03 (Continued)**

| Borehole | Top Depth [feet] | Bottom Depth [feet] | Thermal Conductivity [W/mK] |
|---|---|---|---|
| SB 03 | 16.5 | 17.5 | 2.54 |
| SB 03 | 17.5 | 18 | 2.79 |
| SB 03 | 18 | 18.5 | 2.45 |
| SB 03 | 18.5 | 19 | 2.62 |
| SB 03 | 19 | 19.5 | 2.47 |
| SB 03 | 19.5 | 20 | 2.45 |
| SB 03 | 20 | 20.5 | 2.45 |
| SB 03 | 20.5 | 21 | 2.59 |
| SB 03 | 21 | 21.5 | 2.57 |
| SB 03 | 21.5 | 22 | 2.75 |
| SB 03 | 22.5 | 23 | 2.53 |
| SB 03 | 23 | 23.5 | 2.50 |
| SB 03 | 23.5 | 24 | 2.45 |
| SB 03 | 24 | 25 | 2.32 |
| SB 03 | 24.5 | 25 | 2.27 |
| SB 03 | 25 | 25.5 | 2.40 |
| SB 03 | 25.5 | 26 | 2.55 |
| SB 03 | 26 | 26.5 | 2.36 |
| SB 03 | 26.5 | 27 | 2.52 |
| SB 03 | 26.5 | 27.5 | 2.37 |
| SB 03 | 30 | 30.5 | 2.54 |
| SB 03 | 30.5 | 31 | 2.24 |
| SB 03 | 31 | 31.5 | 2.48 |
| SB 03 | 31.5 | 32 | 2.46 |
| SB 03 | 32 | 33 | 2.43 |
| SB 03 | 33 | 33.5 | 2.49 |
| SB 03 | 33.5 | 34 | 2.34 |
| SB 03 | 34 | 34.5 | 2.43 |
| SB 03 | 34.5 | 35 | 2.30 |
| SB 03 | 35 | 35.5 | 2.40 |
| SB 03 | 35.5 | 36 | 2.37 |
| SB 03 | 36 | 37 | 2.34 |
| | | Minimum | 2.24 |
| | | Maximum | 2.83 |
| | | Average | 2.50 |
| | | Median | 2.47 |

**Table 19. Effective Thermal Conductivity Values from Laboratory Measurements on Samples from Borehole SB04**

| Borehole | Top Depth [feet] | Bottom Depth [feet] | Thermal Conductivity [W/mK] |
|---|---|---|---|
| SB 04 | 0.3 | 2.5 | 2.58 |
| SB 04 | 2.5 | 5 | 2.61 |
| SB 04 | 5 | 7 | 2.52 |
| SB 04 | 7 | 9 | 2.70 |
| SB 04 | 9 | 11 | 2.67 |
| SB 04 | 11 | 12 | 2.68 |
| SB 04 | 12 | 16.5 | 2.32 |
| SB 04 | 16.5 | 17.5 | 2.49 |
| SB 04 | 17.5 | 20 | 2.48 |
| SB 04 | 20 | 22.5 | 2.45 |
| SB 04 | 22.5 | 24.5 | 2.80 |
| SB 04 | 24.5 | 26.5 | 2.38 |
| SB 04 | 26.5 | 27.5 | 2.72 |
| SB 04 | 27.5 | 30.5 | 2.49 |
| SB 04 | 30.5 | 34 | 2.19 |
| SB 04 | 30.5 | 34 | 2.41 |
| SB 04 | 34 | 37 | 2.40 |
| SB 04 | 37 | 40 | 2.60 |
| | | Minimum | 2.19 |
| | | Maximum | 2.80 |
| | | Average | 2.53 |
| | | Median | 2.51 |

The laboratory measurements indicated an average effective thermal conductivity of the sediment of 2.5 W/mK. This value typically represents the no-flow apparent thermal conductivity of the aquifer system under zero-gradient (no flow) conditions. However, many of the baseline results in the observed A-DTS data (presented below) showed a consistently lower apparent thermal conductivity, around 1.9 W/mK. This discrepancy suggests a potential bias toward higher values in the lab measurements. This bias could be attributed to differences in compaction/porosity or saturation between the lab samples and the in-situ sediment. Consequently, porosity within the numerical model was adjusted during calibration to bring the effective thermal conductivity of the sediment in the model down to match the lower value observed in the A-DTS field data (1.9 W/mK).

The model outputs allow the empirical relationship between the in-situ apparent thermal conductivity and the groundwater flux (specific discharge) at each of the A-DTS measurement intervals along the fiber optic cable. A square root function was fit to the data to establish the empirical relationship:

$$q = \beta\sqrt{(\lambda_a - \lambda_0)}$$

Where:

q = groundwater flux

β = fitting parameter determined using least squares

$\lambda_a$ = A-DTS derived apparent thermal conductivity

$\lambda_0$ = apparent thermal conductivity where q=0 (1.9 W/mK, in this case).

Based on the numerical modelling and least squares fit, β was determined to be $2.93 \times 10^{-6}$ for this A-DTS test geometry and parameters (Figure 24, below).

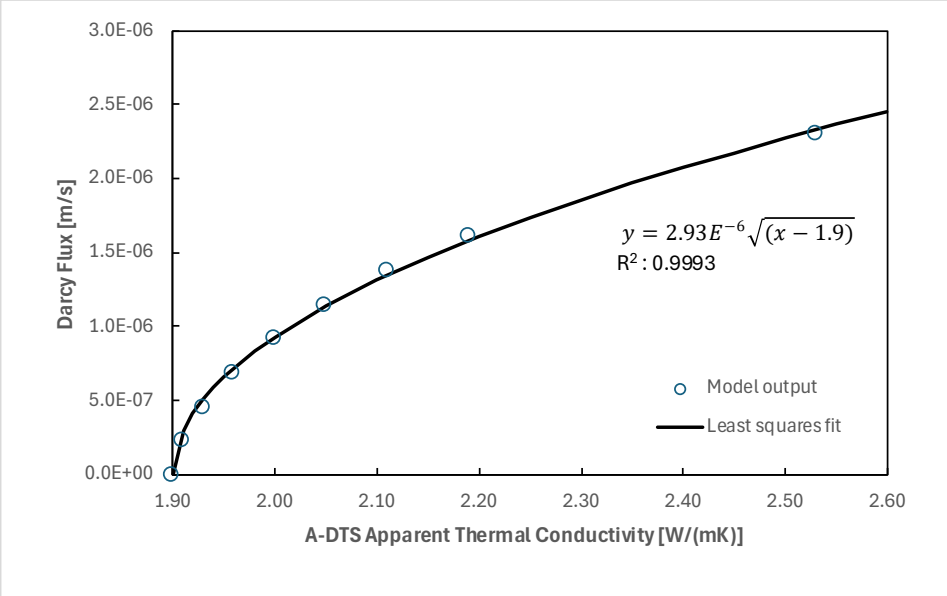



**Figure 24. Model Output and Least Squares Fit to Estimate Groundwater Flux from the A-DTS Apparent Thermal Conductivity Data**

Using the site-specific empirical relationship, the specific discharge, q, for each monitoring interval along the fiber optic cable can be estimated from the apparent thermal conductivity value for each snapshot. As this provides hundreds of measurements along the cable, the discrete values were averaged along the 10-foot screened intervals to provide a more direct comparison to the other flux measurement methods applied in this study.

#### *5.6.3.2 A-DTS Groundwater Flux from Horizontal Deployments*

As described in Section 5.4, two horizontal composite fiber optic cables were deployed: one integrated into the shallow transect VWS and the other a stand-alone cable running parallel to the VWS with a horizontal offset of approximately 12 feet. The two cables were spliced together to form a continuous network, allowing simultaneous A-DTS testing of both cables. Nine A-DTS sampling events were conducted: October and December 2021; April, June, and August 2022; October 2023; and January, April, and July 2024. For each event, 30 minutes of background temperature data were recorded, followed by 24 hours of active heating at an output of 10 W/m. Figures 25 and 26, below, present data montages from the horizontal fiber optic A-DTS installs in the stand-alone and shallow transect VWSs, respectively. These include continuous profiles of apparent thermal conductivity from the A-DTS heating data, the resultant groundwater flux for every DTS sampling interval using the empirical relationship shown on Figure 24 (above), and flux averaged over the 10-foot well screen intervals for the shallow transect. The mean flux value across the screen intervals for both the stand-alone and VWS fiber optic installations are presented in Tables 20 and 21 (below), respectively, with the percent difference between the two installations presented in Table 22, below.

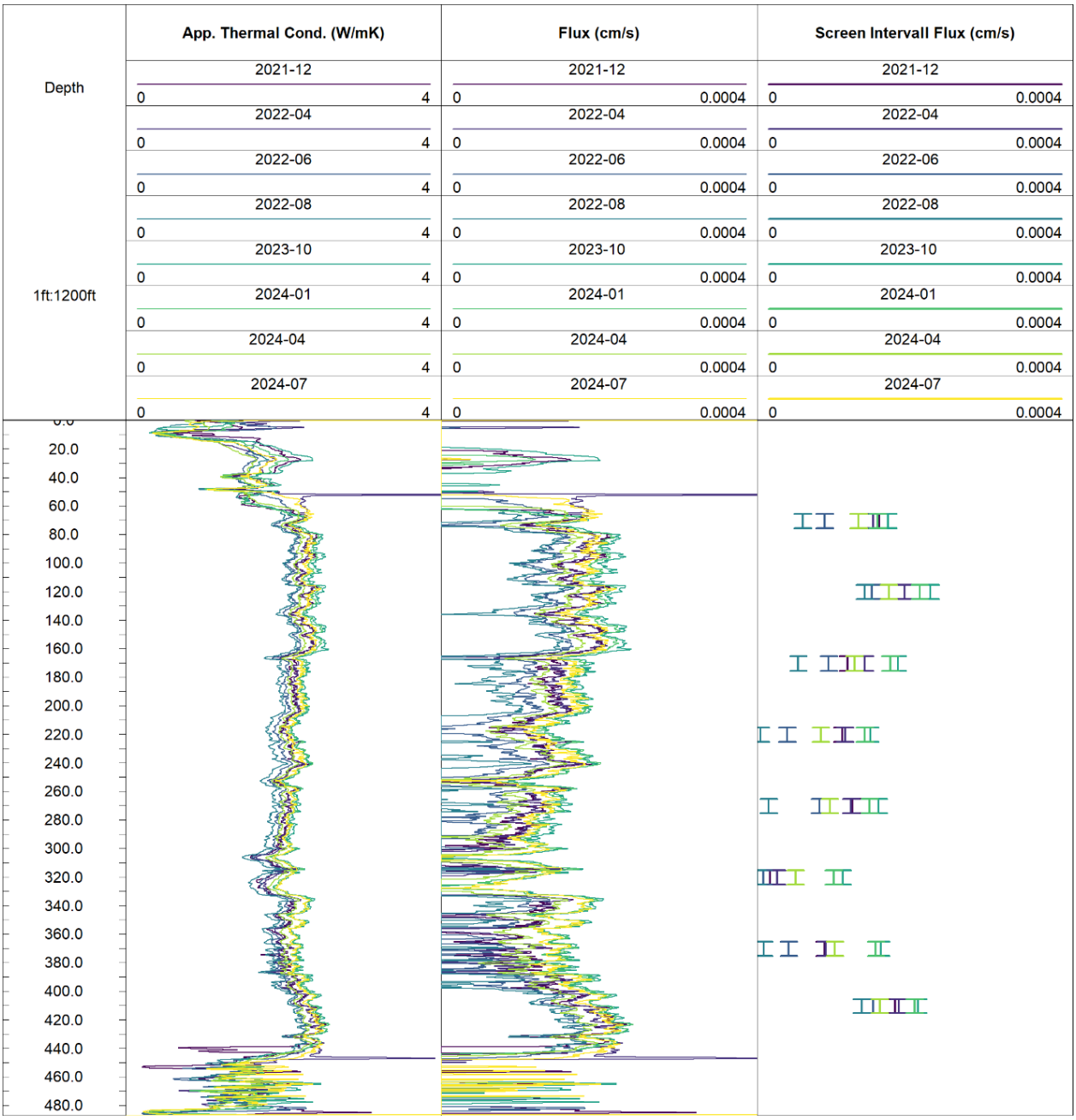



**Figure 25. A-DTS Result Montage for the Stand-Alone Horizontal Fiber Optic Cable**

*Montage includes (from left to right) distance (from eastern wellhead), apparent thermal conductivity, groundwater flux for each sampling interval on the DTS (12.5 cm along cable), and groundwater flux averaged across each 10-foot well screen interval.*

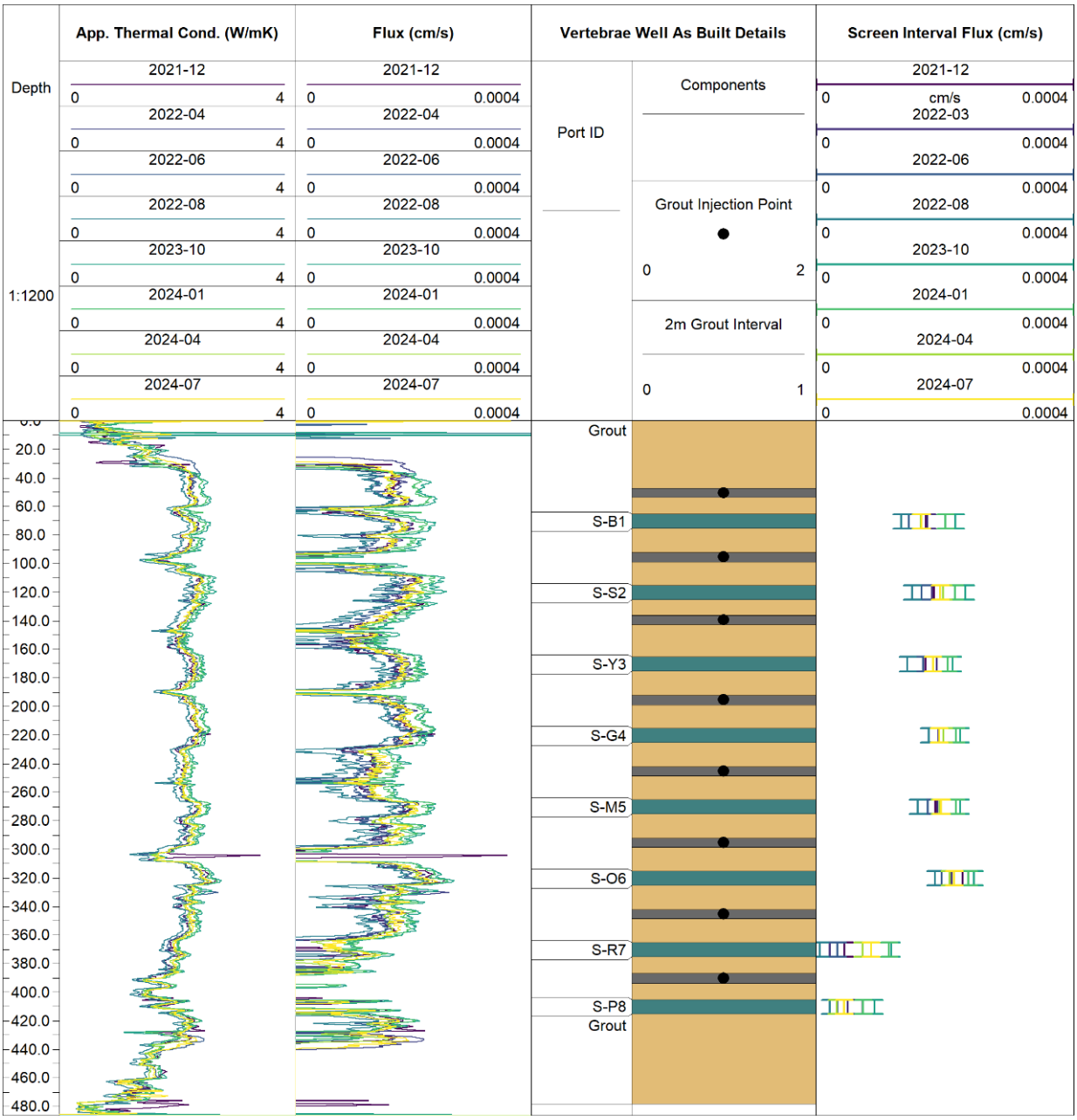



**Figure 26. A-DTS Result Montage for the Horizontal Fiber Optic Cable Integrated into the Shallow VWS**

*Montage includes (from left to right) distance (from eastern wellhead), apparent thermal conductivity, groundwater flux for each sampling interval on the DTS (12.5 cm along cable), VWS completion details, and groundwater flux averaged across each 10-foot well screen interval.*

**Table 20. Standalone Cable A-DTS Groundwater Flux Values Averaged Across the VWS Screen Intervals for the Eight Snapshots.**

| VWS | Dec-21 | Apr-22 | Jun-22 | Aug-22 | Oct-23 | Jan-24 | Apr-24 | Jul-24 | Min | Max | Mean | Median |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interval ID | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day |
| S-B1 | 0.4 | 0.4 | 0.2 | 0.2 | 0.5 | 0.4 | 0.4 | 0.5 | 0.2 | 0.5 | 0.4 | 0.4 |
| S-S2 | 0.5 | 0.5 | 0.4 | 0.4 | 0.6 | 0.6 | 0.5 | 0.6 | 0.4 | 0.6 | 0.5 | 0.5 |
| S-Y3 | 0.3 | 0.4 | 0.3 | 0.1 | 0.5 | 0.5 | 0.3 | 0.5 | 0.1 | 0.5 | 0.4 | 0.4 |
| S-G4 | 0.3 | 0.3 | 0.1 | 0.0 | 0.4 | 0.4 | 0.2 | 0.3 | 0.0 | 0.4 | 0.3 | 0.3 |
| S-M5 | 0.3 | 0.3 | 0.2 | 0.0 | 0.4 | 0.4 | 0.3 | 0.4 | 0.0 | 0.4 | 0.3 | 0.3 |
| S-O6 | 0.0 | 0.1 | 0.0 | 0.0 | 0.3 | 0.3 | 0.1 | 0.3 | 0.0 | 0.3 | 0.1 | 0.1 |
| S-R7 | 0.2 | 0.2 | 0.1 | 0.0 | 0.4 | 0.4 | 0.3 | 0.4 | 0.0 | 0.4 | 0.3 | 0.3 |
| S-P8 | 0.5 | 0.5 | 0.4 | 0.4 | 0.6 | 0.6 | 0.4 | 0.5 | 0.4 | 0.6 | 0.5 | 0.5 |

**Table 21. VWS Fiber Optic Cable A-DTS Groundwater Flux Values Averaged Across the VWS Well Screen Intervals for the Eight Snapshots.**

| VWS | Dec-21 | Apr-22 | Jun-22 | Aug-22 | Oct-23 | Jan-24 | Apr-24 | Jul-24 | Min | Max | Mean | Median |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interval ID | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day | ft/day |
| S-B1 | 0.5 | 0.5 | 0.4 | 0.4 | 0.6 | 0.6 | 0.5 | 0.5 | 0.4 | 0.6 | 0.5 | 0.5 |
| S-S2 | 0.5 | 0.5 | 0.5 | 0.4 | 0.7 | 0.6 | 0.6 | 0.5 | 0.4 | 0.7 | 0.5 | 0.5 |
| S-Y3 | 0.5 | 0.5 | 0.5 | 0.4 | 0.6 | 0.6 | 0.5 | 0.5 | 0.4 | 0.6 | 0.5 | 0.5 |
| S-G4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.5 | 0.5 | 0.6 | 0.6 | 0.5 |
| S-M5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.6 | 0.6 | 0.5 | 0.6 | 0.4 | 0.6 | 0.5 | 0.5 |
| S-O6 | 0.6 | 0.6 | 0.6 | 0.5 | 0.7 | 0.7 | 0.6 | 0.6 | 0.5 | 0.7 | 0.6 | 0.6 |
| S-R7 | 0.1 | 0.1 | 0.1 | 0.0 | 0.3 | 0.3 | 0.2 | 0.2 | 0.0 | 0.3 | 0.2 | 0.2 |
| S-P8 | 0.2 | 0.1 | 0.1 | 0.1 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.3 | 0.1 | 0.1 |

**Table 22. Groundwater Flux Percent Difference Between Stand-Alone Fiber Optic Cable and Fiber Optic Cable Installed with VWS.**

| VWS | Dec-21 | Apr-22 | Jun-22 | Aug-22 | Oct-23 | Jan-24 | Apr-24 | Jul-24 | Mean (absolute) | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Interval ID | % change | % change | % change | % change | % change | % change | ft/day | ft/day | ft/day | ft/day |
| S-B1 | 11% | 18% | 68% | 130% | 30% | 31% | 26% | 1% | 39% | 39% |
| S-S2 | -2% | -3% | 12% | 9% | 6% | 4% | 18% | -2% | 7% | 5% |
| S-Y3 | 49% | 38% | 85% | 175% | 19% | 21% | 48% | 13% | 56% | 56% |
| S-G4 | 77% | 71% | 406% | | 57% | 60% | 145% | 57% | 109% | 125% |
| S-M5 | 54% | 58% | 118% | | 45% | 53% | 108% | 42% | 60% | 68% |
| S-O6 | | 737% | | | 127% | 144% | 327% | 104% | 180% | 287% |
| S-R7 | -48% | -75% | -17% | | -25% | -25% | -26% | -40% | 32% | -37% |
| S-P8 | -59% | -72% | -77% | -84% | -56% | -63% | -79% | -77% | 71% | -71% |

**Note:**

1. The colors represent a gradient showing flow magnitude difference comparing the VWS A-DTS test relative to the standalone A-DTS test. The red indicates a decreased measured flow in the VWS test relative to the standalone test, the blue represents an increase, and the white represents no change.

The flux results averaged across the well screen intervals from the A-DTS tests show a reasonable match to other flux estimate methods, and also between the stand-alone installation and installation that is co-deployed with the VWS. In nearly all ports, there was an elevated flux measured from the cable co-deployed with the VWS screen, with most ports experiencing an approximately 30 to 70% enhancement relative to the stand-alone cable (Table 22, above). The exception is the two ports on the westernmost end of the shallow transect VWS, S-R7 and S-P8, which both show a measurable decrease in flux. The increase in flux observed in most of the ports is likely attributable to flow convergence from the open tubing intervals in the VWS screen, creating a high K interval within the aquifer. This convergence is accounted for in other flux methods using an enhancement factor, and these A-DTS results could provide a means to quantify the enhancement factor for similar deployments. The two ports that measure a consistent decrease in flux (S-R7 and S-P8) appear to have been impacted by grout placement over the screened intervals. This is demonstrated in the following section where the DTS data were used to identify the position and length of grout seals. This grout interference would decrease the A-DTS flux estimates in these intervals in two ways:

- The permeability of the grout materials is significantly lower and one would expect the flux within grouted intervals to be lower than in the non-grouted intervals.
- The grout likely has a lower effective thermal conductivity, which would bias the flux estimates low using the modelled empirical relationship to estimate flux shown on Figure 24, above. This effect can be observed by the regular decreases in apparent thermal conductivity and flux near grouted intervals shown on Figure 26, above.

#### *5.6.3.3 A-DTS Groundwater Flux from Vertical Deployments*

At the vertical fiber optic borehole locations (DTS-1, DTS-2, DTS-3, DTS-4; Figure 27), A-DTS data were collected at each sampling event described above. For the first five field events, data were collected by connecting the four individual locations using surface composite fiber optic cable to form a continuous network. This allowed simultaneous testing of all four locations but had an unanticipated data quality issue resulting from the significant temperature changes of the surface heating wires during the 24-hour heating test, leading to a thermal imprint in all of the temperature data collected. These fluctuations were attributed to daily temperature shifts and varying degrees of direct sunlight exposure, which in turn altered the electrical resistance of the copper heating wires. The resulting resistance changes impacted the power output throughout the network, affecting the downhole data as well. Initially, it was unclear what was causing this thermal imprint on the data. Once discovered, several attempts to mitigate the effect were implemented, including using separate white heating wires and heavier gauge heating wire (12 vs. 18 American Wire Gauge), but this was not sufficient to eliminate the thermal imprint. Given that burying the surface cable was not feasible at the GAAF due to the cost and presence of underground utilities, a decision was made to run individual A-DTS tests at the four locations. This reduced the data collection efficiency but resulted in significantly higher data quality. In October 2021, a full 24-hour individual test was run at the DTS-2 location with excellent results. Subsequently, in January 2024, there was an attempt to perform individual A-DTS tests at all four locations. However, due to a winter storm and substantial snow accumulation from drifts and snow removal operations, only two locations (DTS-2 and DTS-4) were accessible and tests were conducted. In April 2024, A-DTS tests were successfully carried out at all 4 locations, and in July 2024, successful tests were collected at DTS-1, DTS-2 and DTS-3 locations. The results from all successful tests, presented as apparent thermal conductivity and groundwater flux measurements, are shown in Figure 28, below.

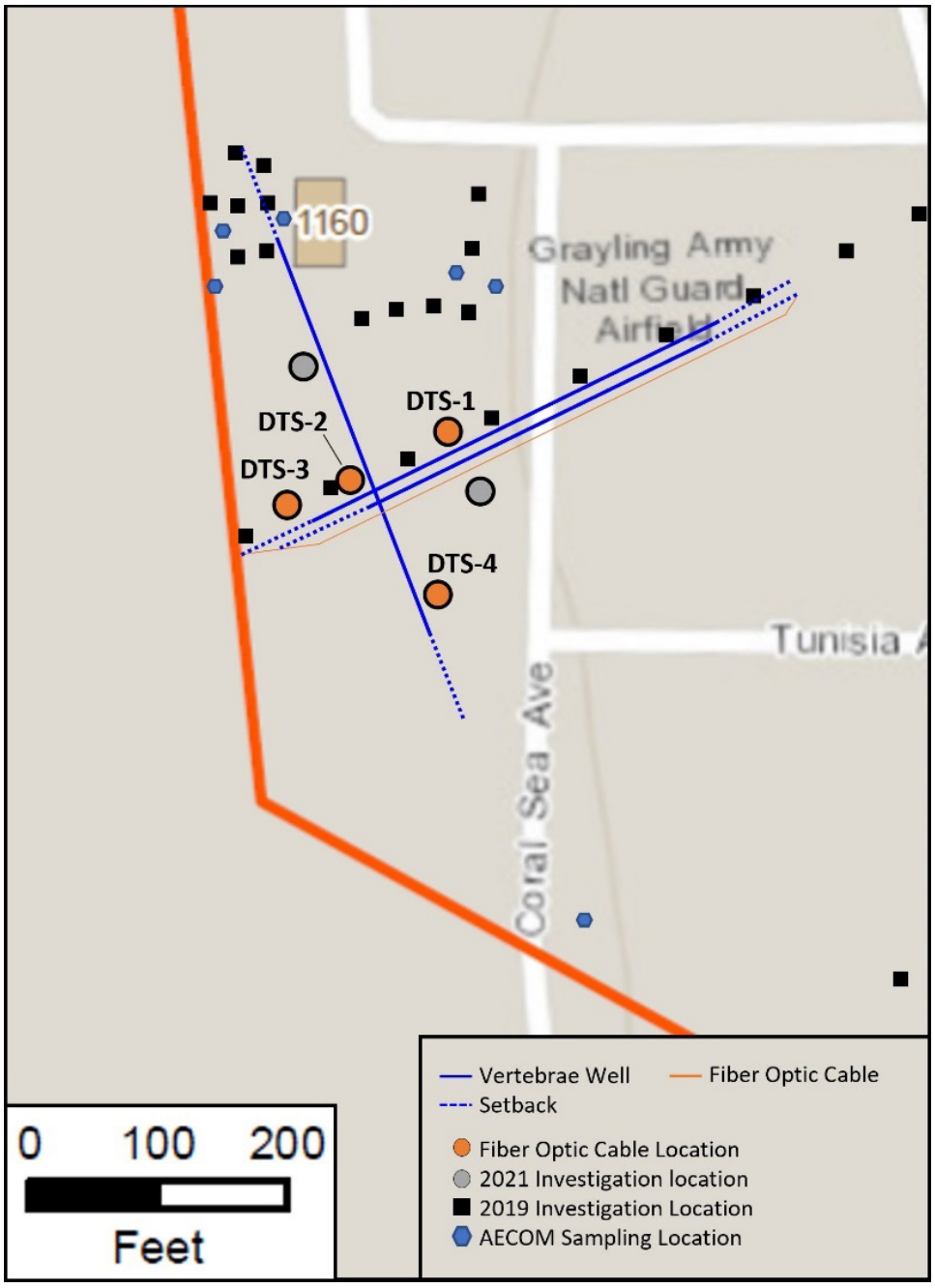



**Figure 27. GAFF Site Map Showing the Location of the Four Vertical A-DTS Locations (DTS-1, DTS-2, DTS-3, and DTS-4)**

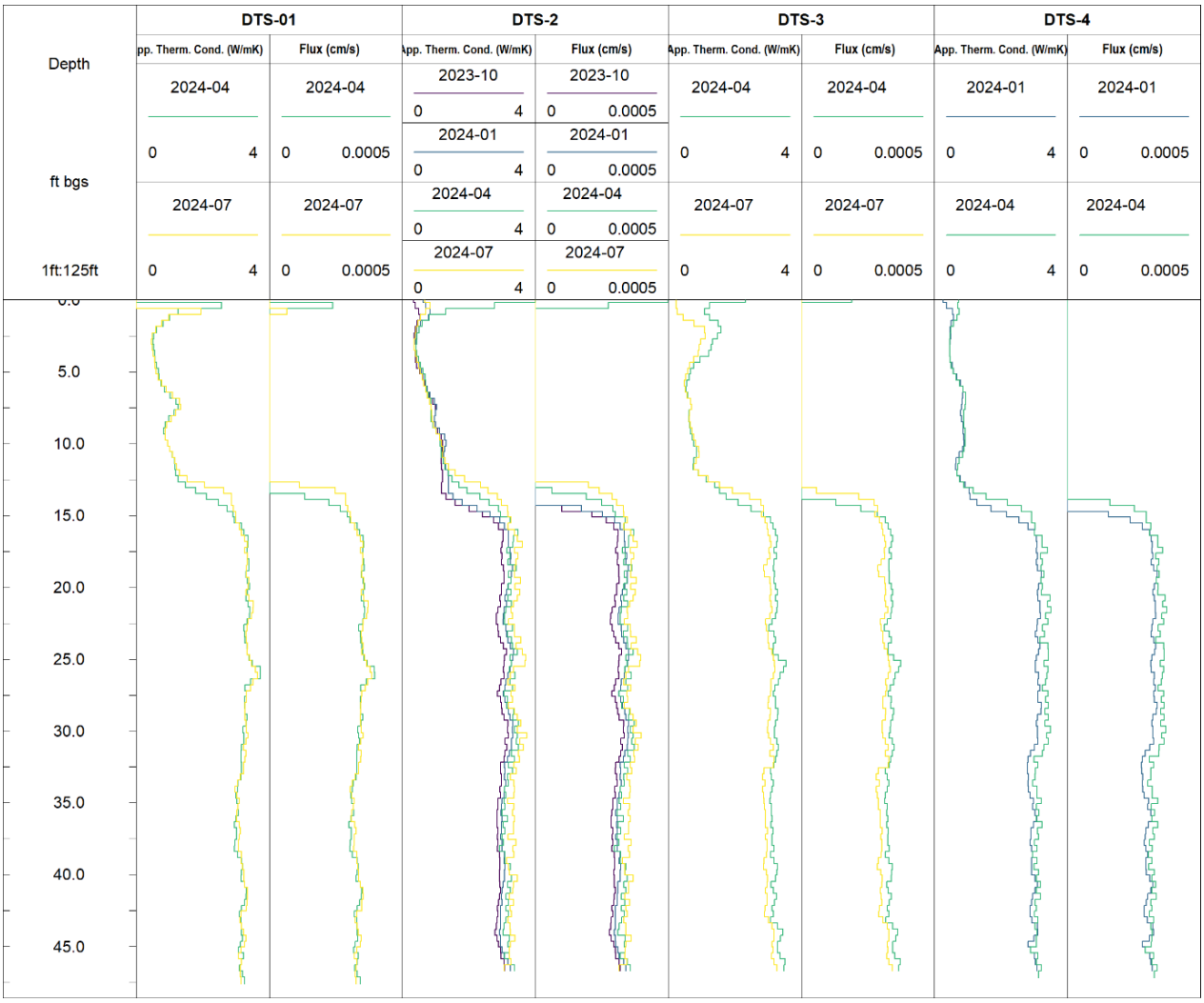



**Figure 28. A-DTS Result Montage for the Vertical Fiber Optic Cable Installations**

*Montage includes (from left to right) depth (feet bgs), and apparent thermal conductivity and groundwater flux data for the DTS-1, DTS-2, DTS-3 and DTS-4 locations.*

The vertical A-DTS tests successfully generated detailed vertical profiles of groundwater flux at 4 locations across the site. Subtle changes in the apparent thermal conductivity above the water table (generally around 12-13 ft below ground surface based on Figure 28) likely correspond to variations in moisture content in the vadose zone, potentially indicating an effective means for measuring vadose zone saturation or recharge rates. The apparent thermal conductivity and flux results below the water table are quite repeatable from snapshot to snapshot, though minor variation from snapshot to snapshot is recorded, likely due to changes in the hydraulic gradient magnitude. While fairly uniform flux with depth is measured, there is indication of several minor preferential flow layers, such as the small peak in apparent thermal conductivity around 26 ft below ground surface, in DTS-1, DTS-2 and DTS-3.

#### *5.6.3.4 Assessing Grout Seal Location and Extent using A-DTS Data*

Temperature data were used to assess the final position and extent of the cement grout that was injected between ports in the shallow transect VWS. This was done using two approaches. The first approach used the natural thermal signature of the curing Portland cement in the grout mixture, which generates heat, and involved a passive temperature snapshot approximately 20 hours after injecting the grout between the VWS monitoring intervals. The second approach used the contrasting thermal properties of the grout material relative to the sediment to identify grout in the A-DTS test result.

For the passive temperature approach, the natural background temperature trend along the fiber was removed by selecting points along the temperature baseline away from thermal anomalies and fitting a cubic spline through the points. This cubic spline was subtracted from the temperature dataset to highlight temperature deviations away from the background temperature, which we hypothesize are due to curing of the Portland cement in the grout. Figure 29, below, shows the background temperature profile along the fiber with the cubic spline. The interpreted grout seal position and length from this method are presented in Table 23, below. The active heating approach using the thermal responses in the A-DTS apparent thermal conductivity data provided similar results to the passive test and serves as an alternative approach if the initial cement grout curing phase has been missed. The apparent thermal conductivity profiles from the A-DTS test produce a clear decrease in thermal conductivity where the grout seals exist, due to the lower thermal conductivity of the grout materials relative to the aquifer materials (see apparent thermal conductivity dips shown on Figure 26, above). To visualize this, Figure 29, below, provides the apparent thermal conductivity plot with an upper limit of 1.9 W/mK, representing the expected effective thermal conductivity of the sediment. A-DTS apparent thermal conductivity values that fall below this value indicate the likely position of grout seals. Examples of these locations are highlighted using arrows in Figure 29, below. There is good agreement between the passive temperature grout seal placement and the active heating assessment, although the seals create a shorter response in the latter method.

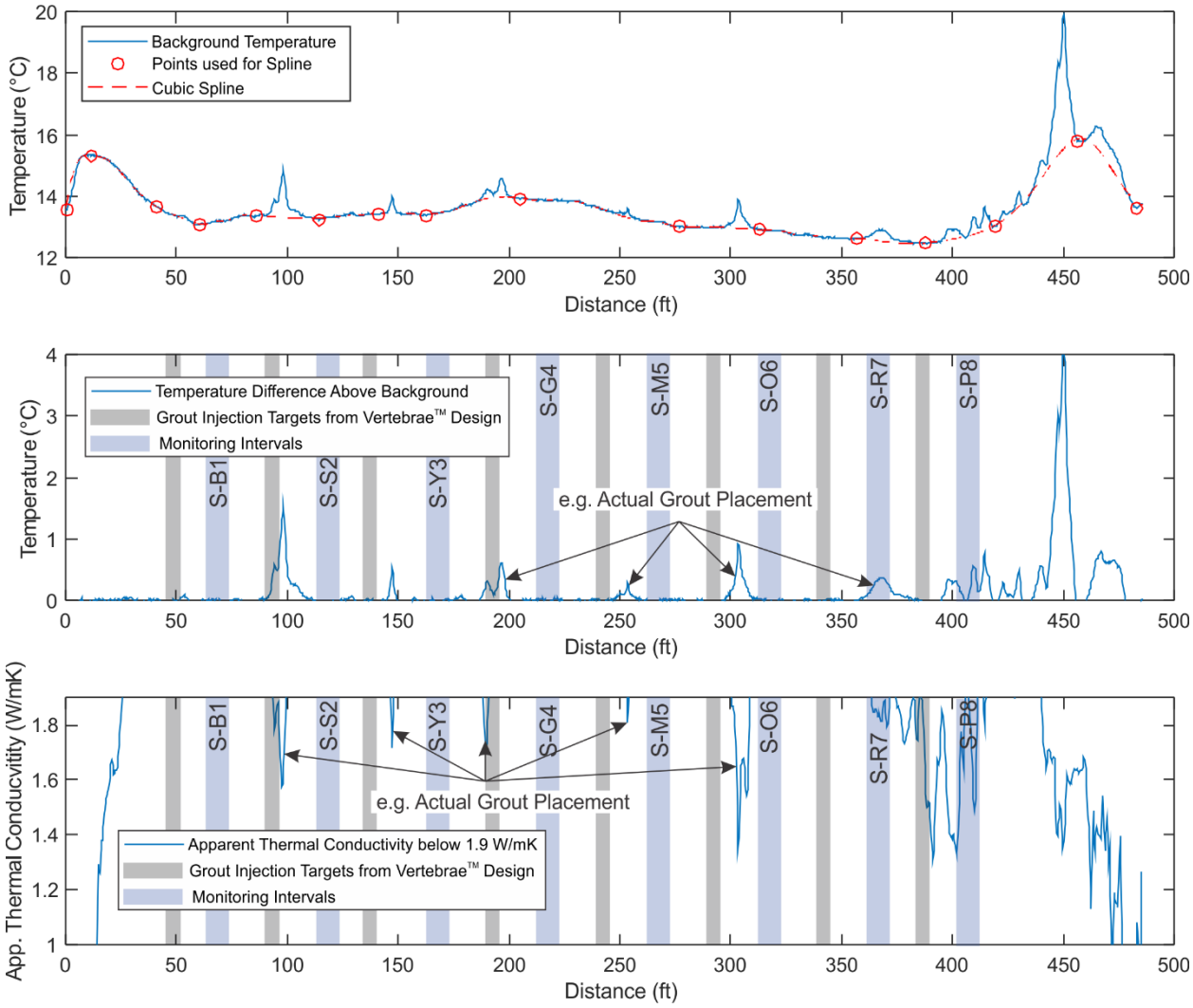



**Figure 29. DTS Temperature Data from the Fiber Optic Cable Installed with the VWS for the Shallow Transect Location**

The temperature data approximately 20 hours after grout injection. Upper: raw temperature data showing cubic spline fit to remove the background trend, Middle: the temperature above background, used to associate the location of injected grout intervals. The targeted VWS grout injection intervals are represented by grey vertical bars and the monitoring intervals are represented by blue vertical bars with the Port ID overlain. Lower: the apparent thermal conductivity A-DTS data from April 2022 showing the anomalously low values that correspond to the grout locations. Note the maximum y-axis value of 1.9 W/mK for the lower plot was used to emphasize the thermal conductivity data below the interpreted sediment value of 1.9 W/mK. There is overall good agreement between the two thermal methods for assessing grout position. Arrows point to example thermal responses corresponding to the actual grout position.

**Table 23. Seal Position and Length Based on Temperature Response Measured with DTS**

| Start Distance | End Distance | Maximum Enhancement Greater Than Background | Inferred Grout Length |
|---|---|---|---|
| feet from wellhead | feet from wellhead | °C | feet |
| 91.3 | 108.3 | 1.51 | 17.0 |
| 144.8 | 149.5 | 0.53 | 4.7 |
| 187.7 | 199.9 | 0.60 | 12.2 |
| 248.2 | 257.2 | 0.29 | 9.1 |
| 297.9 | 309.8 | 0.91 | 11.9 |
| 360.2 | 380.1 | 0.38 | 19.9 |
| 395.4 | 478.1 | 4.36 | 82.7 |

### 5.6.4 Multilevel System Sampling

Groundwater samples from the installed MLS were collected quarterly and analysed for PFAS, contemporaneous with the VWS groundwater sampling events. Low-flow sampling methodology consistent with Arcadis' TGI was used to sample the monitoring wells for PFAS compounds. Geochemical water quality parameters were monitored and recorded during groundwater sampling. Groundwater sampling logs are provided in Appendix I. PFAS groundwater analytical results from the MLS are presented in Tables 13 and 14, and the laboratory analytical reports are provided in Appendix C.

### 5.6.5 Monitoring Well Sampling

Groundwater samples from installed conventional monitoring wells were collected quarterly and analyzed for PFAS, contemporaneous with the VWS and MLS groundwater sampling events. Low-flow sampling methodology consistent with Arcadis' TGI were used to sample the monitoring wells for PFAS compounds. Geochemical water quality parameters were monitored and recorded during groundwater sampling. Groundwater sampling logs are provided in Appendix I. PFAS groundwater analytical results from the monitoring wells are presented in Tables 13 and 14, and the laboratory analytical reports are provided in Appendix C.

### 5.6.6 Monitoring Well Hydraulic and Tracer Testing

The conventional monitoring wells were also utilized for hydraulic testing (i.e., slug tests) and tracer testing, providing K values and groundwater flux estimates that were compared to results obtained using other methods. SWTTs and slug tests were completed at five of the conventional monitoring wells. Falling and rising head tests were conducted in new monitoring wells by inducing a near instantaneous head change using a solid slug of known volume, then monitoring recovery with the pressure transducers. The data were analyzed to estimate K using AQTESOLV (www.aqtesove.com). The monitoring well slug testing results are provided in Appendix D.

SWTT methods are well developed for conventional vertical borings and wells (Drost et al. 1968; Gaspar and Oncescu 1972; Grisak et al. 1977; Hall 1993) and generally consist of replacing the water column in a well or borehole with a tracer solution without imposing an artificial head in the aquifer, and then measuring the subsequent decline of tracer concentration in the well. The observed rate of tracer concentration decrease, or washout, is then interpreted using analytical models to calculate the local groundwater flux and velocity. SWTTs provide a relatively simple, fast, and cost-effective alternative to multiwell tracer tests. However, it is important to note that an SWTT will not provide data to allow determination of groundwater flow direction. A variety of tracers can be used, including fluorescent tracers, anionic halides (e.g., chloride, bromide), and heat. For this project, a salt (sodium chloride) tracer solution was used to achieve the target specific conductivity contrast of approximately 500 microSiemens per centimeter greater than baseline conditions. Alternatively, distilled water can be used to create a reduction in specific conductivity that can be used as a tracer signal.

### 5.6.7 Water Level Measurements

Depth to groundwater was measured in the MLS and conventional monitoring wells, prior to each sampling event. The water level meter was decontaminated prior to initial use and after each subsequent use. Hydraulic head data from the MLS and nested wells also informed hydraulic gradients used in groundwater and contaminant flux estimates from VWS datasets and from vertical datasets (e.g., with the K estimates from grain-size analyses for groundwater flux). An Excel-based tool (HydrogeoEstimatorXL) was employed for the gradient magnitude and direction estimates (Devlin and Schillig 2017). The MLS has two ports that are co-located with the horizontal VWS ports (i.e., spanning the same depth intervals and positioned laterally at the mid-way position of the horizontal port) and the additional vertical information allowed quantification of uncertainty in flux estimates from the horizontal VWS installations.

Data logging pressure transducers were deployed in three monitoring wells. This included MW-VRTB-03S along the VWS transect and upgradient and downgradient wells MW-VRTB-01S and MW-VRTB-02S along the VWS longsect at the same elevation. These locations allowed triangulation to assess changes in horizontal hydraulic gradients during the project monitoring period, which were applied in groundwater and contaminant mass flux/discharge estimates. High-resolution water level and temperature data were transmitted for evaluation via a cellular service. Groundwater elevations were calculated using the surveyed top of casing elevations. An evaluation of hydraulic gradient patterns is provided in Appendix J.

### 5.6.8 Purge Water Waste Management

Liquid waste was generated while sampling the VWSs and vertical monitoring wells during the eight monitoring events conducted after installation of the VWSs. Groundwater purged during sampling, as well as water used for decontamination purposes, was surface spread on site.

# 6.0 DATA ANALYSIS AND FLUX METHODS

A variety of data analysis techniques and statistical methods were used to evaluate the data collected as part of this project, to support assessment of the performance objectives. Data analysis techniques are presented throughout this section, followed by an assessment of each individual performance objective in Section 7.

## 6.1 CONTAMINANT MASS FLUX/DISCHARGE

The hydraulic and concentration data developed through the pre-design characterization activity and performance monitoring were used to estimate groundwater flux and contaminant mass flux/ discharge. Groundwater and contaminant flux are referred to as measurements per unit cross-section area, whereas discharge refers to the integrated values across the entire control plane of interest, ideally covering the entire plume zone. As described by the ITRC (2010) and elsewhere, mass flux/discharge is generally estimated using three general approaches: transect methods, well capture/integral pump test methods, and passive flux meter methods. Comparisons between the different contaminant flux/discharge methods have been presented by Goltz et al. (2007), Beland-Pelletier et al. (2011), and others. The transect methods approach is where horizontal VWSs are mostly applicable for contaminant mass flux/discharge estimation and is further discussed below.

Transect methods (e.g., Guilbeault et al. 2005; Einarson et al. 2010) were applied, in which individual monitoring points are used to estimate groundwater flux and measure groundwater contaminant concentrations. These individual measurements are integrated over the transect area to estimate the total groundwater discharge and contaminant mass discharge, $M_D$, using:

$$M_D = \sum_{i=1}^{N} C_i q_i A_i \qquad \text{(Equation 1)}$$

Where:

$C_i$ is the contaminant groundwater concentration

$q_i$ is the groundwater flux attributed to the element area $A_i$.

Groundwater flux, $q_i$, can be estimated using:

$$q_i = K_i \, x \, i \qquad \text{(Equation 2)}$$

Where:

$K_i$ is the hydraulic conductivity

$i$ is the hydraulic gradient.

A key factor in the use of transects is appropriate spatial resolution (i.e., data density) to adequately define the groundwater and contaminant distributions, in light of the typical large heterogeneity that can occur in unconsolidated sedimentary systems, particularly in the vertical direction, and the commensurate large variability in plume contaminant concentrations, which can also vary by orders of magnitude over short vertical distances. For example, based on detailed transect evaluations at three chlorinated solvent contaminated sites, Guilbeault at al. (2005) showed that orders of magnitude variations in concentrations occurred in vertical distances of 0.10 to 0.30 meter.

At the three sites, as much as 75% of the total mass discharge occurs within 5 to 10% of the plume cross-sectional area, with sampling frequency as tight as 0.10 to 0.30 meter in the vertical direction and a few meters apart in the horizontal direction. In this approach, $q_i$ was estimated indirectly via measurements of K (e.g., via slug tests, short term pump tests, estimates based on lithology or grain size analyses; Cormican et al. 2020) and inferred from HPT data (e.g., McCall and Christy 2020). Hydraulic gradient values ($i$) were estimated from the local groundwater monitoring network (Devlin and Schillig 2017) and is generally the parameter exhibiting the least variability compared to K and contaminant concentration variability. Data from point dilution tracer tests and the A-DTS were also used for direct measures of $q$ values.

Groundwater flux was estimated by multiplying K by the measured site hydraulic gradient, and contaminant mass flux was calculated by multiplying the groundwater flux by the contaminant concentration measured in groundwater samples from each interval. Contaminant mass discharge across a transect can then be assessed by summing the contaminant mass flux for each sampling interval multiplied by its respective representative area (Equation 1). Insights from the vertical characterization can be used to constrain the vertical dimensions applied in the representative area estimates.

The polygon method applied in a simple spreadsheet was used for interpretation of VWS transect data. For EVS-based analysis kriging-based geostatistical methods were used to interpolate the contaminant and K distributions, and to integrate these over transect areas to estimate mass discharge (with user inputs including control points and others to ensure reasonableness). Summation of nodal data from the mass flux model was used to estimate the total mass discharge along transects. The analysis assumes an equidistant grid cell spacing in the model, transects that are perpendicular to groundwater flow, and an average hydraulic gradient from available groundwater elevation measurements.

One performance objective that was assessed during the data analysis and mass flux/discharge comparisons was determining how to achieve optimal placement of the horizontal ports along transect(s), which were guided using high-resolution vertical datasets. Specifically, the focus was on:

- Understanding the necessary data density, given the typical high spatial variability of K and contaminant concentrations within plumes.
- Limitations of installing horizontal systems at different depth intervals across a plume, where two to three systems installed at different depth horizons along a transect may be a practical limit.

High-resolution permeability data collected with HPT and the concentration data collected with VAP borings were evaluated in 3-D using EVS software to facilitate mass flux evaluation. Once assembled in a 3-D model, the interpolated data fields for conductivity and concentration are multiplied together, along with horizontal groundwater gradient, to produce a spatial distribution map that shows an estimate of mass flux on two-dimensional cross sections. This approach provides insight to mass movement, plume maturity, and plume morphology, and allows for future evaluation of remedy approach, location, and design.

In addition to mass flux applications, the EVS model was used for mass discharge estimates. Nodal data from the EVS mass flux model can be summed to estimate a total mass discharge along each transect. Comparison of new transects and estimated mass flux/mass discharge were compared to mass flux/mass discharge estimates from the 2019 ESTCP investigation. Computations in EVS were also used to evaluate minimum data requirements for designing a VWS as described by Performance Objective 4 in Section 7.4.

Every method has inherent biases, limitations, investigation scale and assumptions and no dataset can completely describe the field conditions. The error and uncertainty of the datasets were evaluated by varying assumed parameters, analysis models, examining temporal variability, and examining detection limits (both lower and upper). This step demonstrates how error or uncertainty are propagated and how individual parameter uncertainty contributes to overall uncertainty in flux estimates (Taylor 1997).

## 6.2 TEMPORAL VARIABILITY

Temporal variability of hydraulic gradients and contaminant concentrations were evaluated through time using repeated monitoring of existing wells, MLS, and VWSs. Care was taken to understand any trends that may result due to changes in natural and anthropogenic conditions and, in particular, time-series analysis techniques will target seasonal and operational changes.

For the data evaluations, the zone along Transect 2 within which overlapping vertical characterization data (from prior investigations in 2019 and 2021) with the VWS installations is referred to here as the Transect Control Plane. The only datasets with sufficient spatial coverage to integrate groundwater and contaminant fluxes crossing this plane, using the methodology described in Section 8.1 of the Demonstration Plan (Divine et al. 2021c), will be:

- Horizontal VWS installations spanning the control plane, with two systems at different elevations, each having eight port intervals, and with hydraulic testing providing K estimates from each port interval and groundwater sampling data providing contaminant concentrations.

- Vertical HPT/VAP datasets providing estimated K and discrete concentration data from nine locations across the control plane (six conducted in 2019, three completed in 2021). Each location will have continuous HPT profiles (providing continuous K estimates) and between 5 to 7 depth zones of VAP sampling using an approximately 4-foot-long screened interval providing contaminant concentrations throughout this interval. K estimates from pneumatic slug tests (PSTs) will also be obtained from all 2021 VAP sampling zones along the transect. Horizontal hydraulic gradients from the existing wells and new monitoring infrastructure (including paired vertical wells to be instrumented with transducers, and the 7-port CMT multilevel system) will also be applied in these flux estimates.

The comparison between flux estimates using VWSs and the vertical HPT/VAP dataset provides a basis for evaluation of the accuracy of the VWS assessment for flux assessment for PFAS/PFOS contamination. This is for a scenario where the vertical positioning of the VWS screens were informed by higher resolution vertical profiles, therefore having the greatest chance of successfully delineating groundwater and contaminant flux. Given the high spatial variability expected for the K and contaminant distributions, neither method was expected to produce a perfect result.

The vertical profile datasets should produce a more accurate result given the higher spatial coverage of datapoints. Within the control plane, there will be 16 VWS sample intervals (at two depths) and approximately 50 to 60 VAP sample intervals (five to seven depths; nine locations). Temporal variability in plume concentrations will affect the VAP sample interpretations given the more than 2.5-year time difference between the 2019 and 2021 sampling events. Temporal sampling of the CMT MLS installed as part of this project provided additional insights into the plume temporal variability across the sampling events.

## 6.3 UNCERTAINTY AND BIAS

Beyond the direct comparisons indicated above using the sampling zone estimated K, contaminant concentrations and hydraulic gradients to estimate integrated groundwater and contaminant fluxes across the control plane, further analyses were conducted to estimate the possible uncertainty and bias in these flux estimates. Every method has inherent biases, limitations and assumptions (i.e., there is no correct or ideal dataset to compare against as a standard). For vertical installations, HPT estimated K can be uncertain and influenced by operational conditions, geological conditions, varying probe advance rates, and other things. The 2021 locations along the transect/control plane allowed comparisons of K datasets and groundwater flux profiles at the three locations using:

- HPT estimated K and horizontal hydraulic gradients from monitoring wells
- K estimated at the VAP sample locations and horizontal hydraulic gradients from wells
- K estimated from core samples (grain size/permeameter) with higher resolution at the middle CMT well location and horizontal hydraulic gradients from monitoring wells
- K estimated from slug tests and horizontal hydraulic gradients from monitoring wells
- Groundwater flux from vertical stand-alone fiber optic installations and A-DTS testing.

For the VWS installations, besides hydraulic testing providing K estimates, which were combined with horizontal hydraulic gradient estimates for groundwater flux estimates and integrated across the control plane, horizontal flux profiles were also measured using the A-DTS (deployment of fiber optic cable paired with one of the VWSs, as well as a stand-alone fiber optic cable a short distance away at the same depth interval) for comparison. Tracer tests were also used to assess groundwater flux.

For contaminant flux, groundwater concentrations are combined with the groundwater flux data to estimate contaminant mass fluxes. Differences in contaminant concentrations can be accessed via comparison of different resolution measurements conducted during this study. For example, the VWS spatial coverage is limited in the vertical dimension and could easily miss higher concentration zones, which was assessed by comparison with the higher resolution vertical profiles, including those collected from VAP, CMT multilevel sampling, and from the golden spike high-resolution soil core sampling (Figure 30, below). Integration of the groundwater flux and contaminant flux along profiles at the three locations where the multiple higher resolution vertical datasets were collected, and which overlap with VWS screens, provided a basis for evaluation of the uncertainty of the VWS flux estimates. In summary, while some uncertainties are irreducible and difficult to rigorously quantify, their general significance can be assessed through a redundancy of data, data types, and multiple analysis methods. Overall, the uncertainties in these analyses are considered acceptable for the purposes of this demonstration.

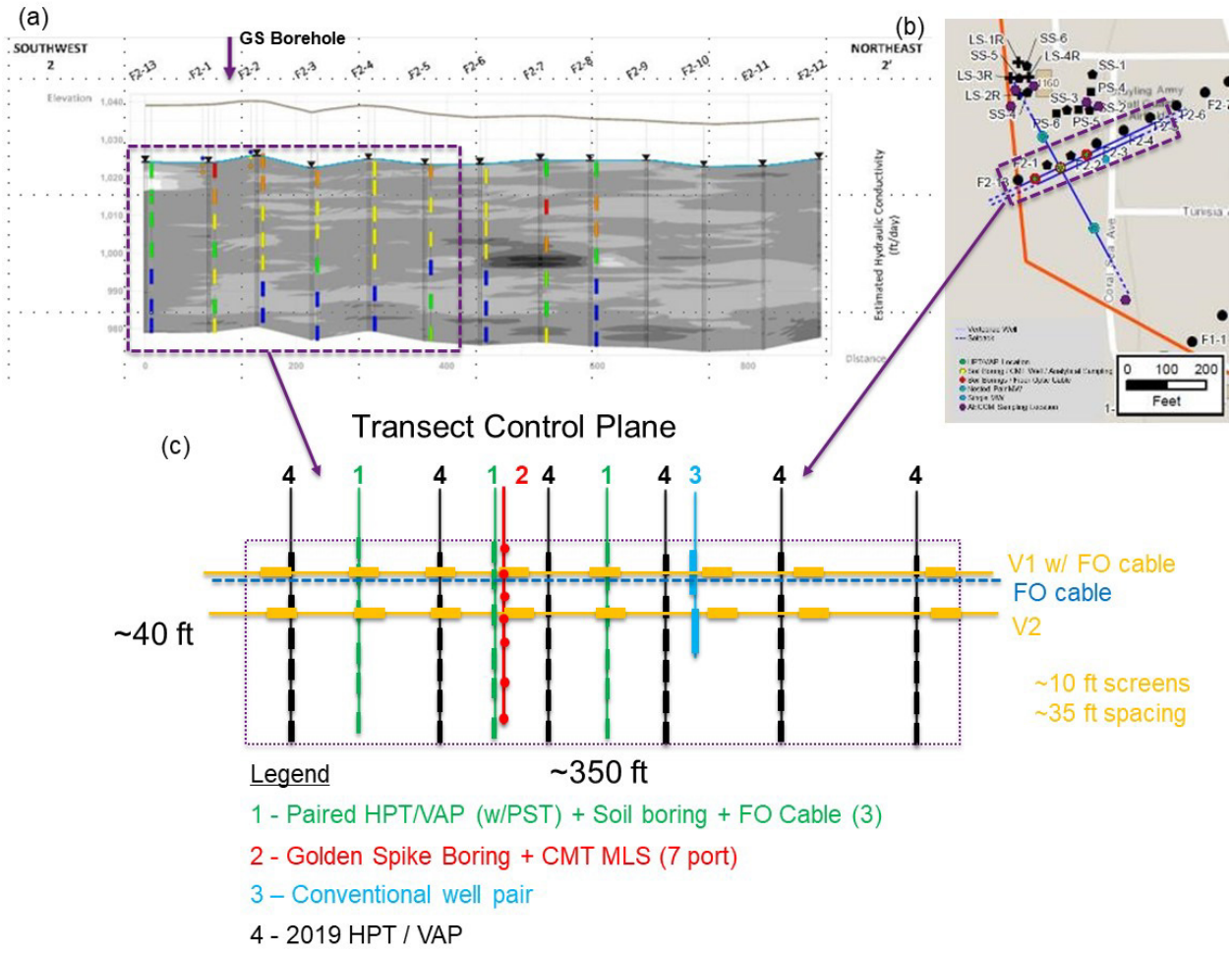



**Figure 30. VWS Data Plots**

*(a) Conditions along Transect 2 showing HPT estimated K and VAP total PFOS concentrations (color coded) from 2019 investigations, (b) Plan view map of the 2019 and 2021 locations, and orientations of the VWSs, and (c) Transect control plane, which we refer to as the interval along the transect where overlapping datasets were collected from the VWS installations and vertical data collection points (2019 and 2021). This highlights conceptually the various datasets collected and used for the groundwater and contaminant flux estimates and to assess the performance/ uncertainty of these estimates from the horizontal VWSs versus the vertical characterization data.*

# 7.0 PERFORMANCE ASSESSMENT

The data collected as part of this project were evaluated to determine if the success criteria for specific quantitative and qualitative performance objectives presented in Table 1 were achieved. This section discusses the assessment of each performance objective.

## 7.1 QUANTITATIVE PERFORMANCE OBJECTIVE 1: ACCURATE AND RELIABLE PLACEMENT OF SCREENS IN SUBSURFACE

This performance objective is intended to:

- Assess the reliability of bore-path navigation data for documenting as-built completion.
- Verify that the VWS can be successfully installed at planned target depth intervals.

### 7.1.1 Data Collected

The following data were collected to evaluate accurate and reliable placement of the VWS screens:

- Prior to directional drilling operations (September 2021):
  - The target bore paths were professionally surveyed and staked. The positions of the survey markers were provided in State Plane coordinates and the elevations were referenced to feet above mean sea level.
- During directional drilling (October 2021):
  - A walkover locating system was used to track the position of the drill head. The position of the drill head was marked when an additional drill rod was added to the drill string (every 10 feet).
  - Distances between the drill head and the pre-surveyed stakes were measured to determine the horizontal deviation from the planned bore path.
  - The depth of the drill head was also painted on the ground beside the rod marking (Figure 31, below).

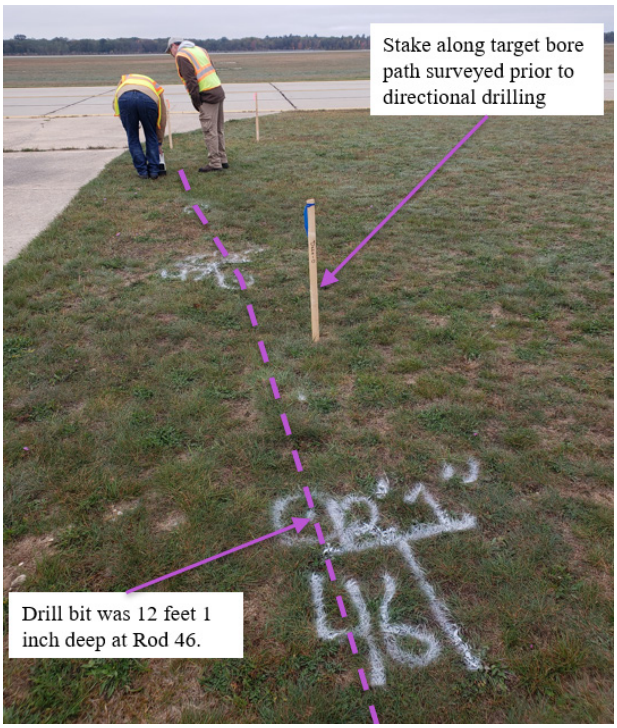



**Figure 31. Directional Drilling Navigation**

- After installation of the VWSs (August 2022):
  - A total of 19 as-built points along the shallow and deep transects were re-marked. This included the east end of all 16 screens plus the west end of three of the screens. Both ends of the three screens were surveyed because they are within the curved portion of the bore and there is a slope from one end of the screen to the other.
  - The locations of the screens at the shallow and deep transects were determined using RF inductive line tracing with a multifrequency transmitter and receiver. The RF line tracing involves connecting the multifrequency transmitter to a high-strength copper clad tracing wire that was bundled with the VWSs during installation, applying a frequency specific signal to the tracing wire, locating the dedicated frequency at specified intervals along the wells, and recording the depth determined by the receiver.

This resulted in three sets of coordinates for comparison:

1. Planned coordinates
2. As-built coordinates from the drilling navigation system
3. As-built coordinates from inductive line tracing.

The coordinates were then used to calculate vertical differences for comparison to the success criteria.

### 7.1.2 Data Interpretation

Success is considered achieved if:

- At least 80% of all drilling navigation data agree within 1.5 feet (elevation) of the bore path elevation determined by geophysical survey.
- Eighty percent of the as-built data agree within 1.5 feet of the planned target depth elevations.

The goal was to install the VWS within 1 foot of the planned target depth. However, there are inherent limitations in the accuracy of depth measurements collected during and after directional drilling. The two main factors (discussed further in the next paragraph) that affect depth accuracy are:

1. The borehole is reamed to a diameter approximately 50% larger than well materials.
2. The exact position of tracer wire is not consistent and can vary between top, bottom, and sides of well.

For these reasons, depth measurements during (drilling navigation data) and after VWS installation (geophysical methods) have an inherent irreducible uncertainty of +/- 0.5 foot. Therefore, the depth accuracy of +/- 0.5 foot was added to the goal of +/- 1 foot, resulting in the overall target tolerance limit of 1.5 feet.

Well diameter affects the accuracy of the depth measurements, with larger well diameters resulting in less accurate depth measurements. This is because of differences between the depths obtained during pilot bore drilling and the actual well installation depth. The borehole navigation data are obtained during pilot hole drilling, from a sonde behind the drill head. Then the borehole is reamed, typically to 50% larger than the well materials, followed by pulling the well into place. The final position of the well materials is at the bottom of the borehole, due to the weight of the drill pipe/ well materials and stresses imparted as the well materials are pulled through the curved sections of the borehole. This results in uncertainty between the depth measured during borehole navigation and the final depth of the well materials. In the case of the VWSs, the 4-inch-diameter pilot bore was reamed to a final diameter of 6 inches. Another factor that affected the accuracy measured using the RF is the location of the tracing wire on the VWS. The final position of the tracer line could be anywhere around the circumference of the well (top, middle, or bottom) depending on rotation of the well materials during pullback.

As presented in Table 24, below, the differences between the measurements were within the tolerance limit of + / - 1.5 feet for all six horizontal screens. When evaluating this performance objective, only the six shallow transect VWS screens along the horizontal section were considered (Figure 32, below). The two screens on the slopes (one at each end) of the shallow transect were omitted due to decreased accuracy of the walkover locating system when drilling at an angle from horizontal. When drilling at an angle, the three signals (front, back, and center sight) emitted by the sonde travel a longer distance to the receiver at the surface, which decreases the accuracy. A future recommendation (see Section 9) is to avoid placing screens on the sloped portion of the wellbore, due to decreased locating accuracy. In addition, the angled screen orientation increases the potential for grout intrusion into the screen, which is another reason to avoid installing screens at an angle.

***Based on the discussion above, the performance objective related to accurate and reliable placement of VWS screens in the subsurface is considered achieved.***

**Table 24. Comparison of Planned and Actual VWS Locations**

| Screen ID | Difference between HDD Navigation Data and Planned Target Depth (feet) | Difference Between HDD Navigation Data and Electromagnetic Line Tracing Depth (feet) |
|---|---|---|
| S-R7 | 0.32 | 0.08 |
| S-O6 | 0.19 | 0.25 |
| S-M5 | 0.20 | 1.42 |
| S-G4 | 0.10 | 1.00 |
| S-Y3 | 0.58 | 0.75 |
| S-S2 | 0.13 | 1.42 |
| % Agreement (less than 1.5 feet) | **100% (6 of 6)** | **100% (6 of 6)** |

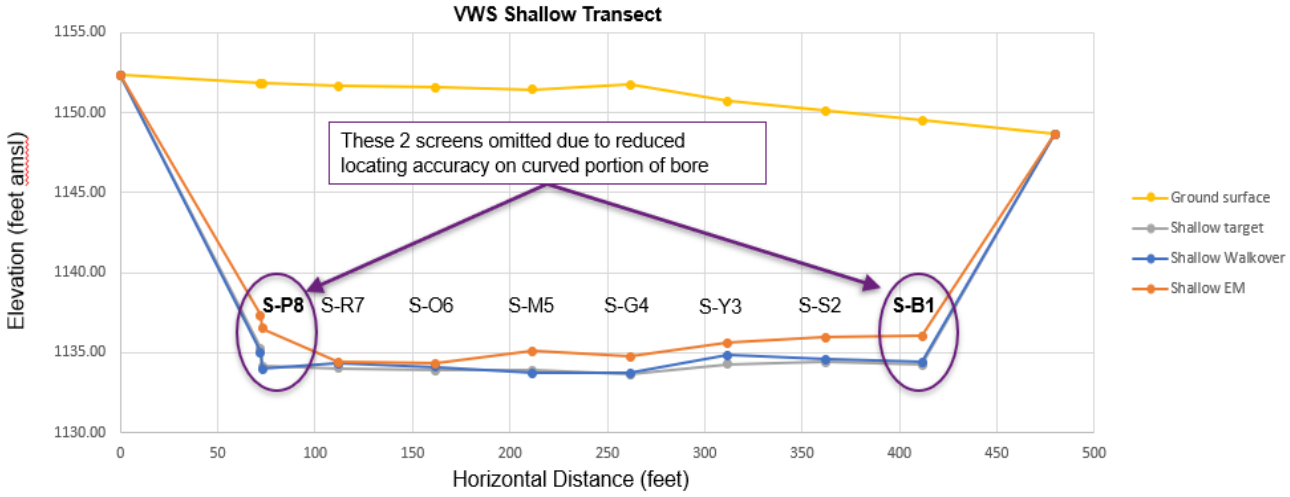



**Figure 32. Comparison of Planned VWS Screen Depths, As-Built Coordinates from the Drilling Navigation System, and As-Built Coordinates from Inductive Line Tracing**

## 7.2 QUANTITATIVE PERFORMANCE OBJECTIVE 2: VALIDATE METHODS FOR GROUNDWATER FLUX MEASUREMENT WITH VWSS

This performance objective is intended to assess the reliability and usefulness of several different methods for measuring groundwater flux across a VWS.

### 7.2.1 Data Collected

Groundwater flux across the transect was measured by multiple independent methods. The first method used K estimated from hydraulic tests completed during HPT activity prior to VWS installation. The measured K values at locations equivalent to the final VWS screen locations were used, and groundwater flux was calculated with the site average horizontal hydraulic gradient at the time of sampling, according to Darcy's Law. The second method was based on groundwater flux directly measured from SWTTs which is then used to determine representative K values for each screen segment. The third method used data from active fiber optic A-DTS. Because the DTS system was only installed along the shallow transect, the groundwater flux and flow calculations for each method are compared for only the shallow zone.

Another method that was evaluated was applicability of slug testing with VWSs. Slug testing was attempted using both inflow (falling head) and pneumatic slug testing methods. The inflow method involved inducing a known volume of water into the individual VWS segments. Pneumatic slug testing involved pressurizing the water column with air. It was concluded that skin effects were likely present, with slug testing results biased low and unreliable due to friction losses associated with the geotextile membrane used in the VWS construction. Therefore, VWS slug testing is not recommended or included in the following data interpretation.

### 7.2.2 Data Interpretation

Figure 33 (left), shows the average screen segment flows (average of eight monitoring events) for each of the primary comparison methods (HPT, SWTT, and A-DTS). Figure 33 (right) shows total transact calculated flow for each monitoring event. For comparison, this figure also shows average flows calculated using K-estimates based on size analyses from soil core samples ("Grain Size") and geostatistical-based (i.e., kriging) model of K-distribution based on all available K information at the site. The results based HPT data are notably lower than the other two methods for all segments and events. It is likely that for the GAAF, this is a biased-low method because the range for most K measurements at the GAAF (Figure 34, 30 to 300 ft/day) is near the approximate upper method limit for HPT testing (approximately 50 to 100 ft/day). Therefore, the HPT method is not considered reliable for the GAAF; however, it may be appropriate for sites with lower hydraulic conductivity.

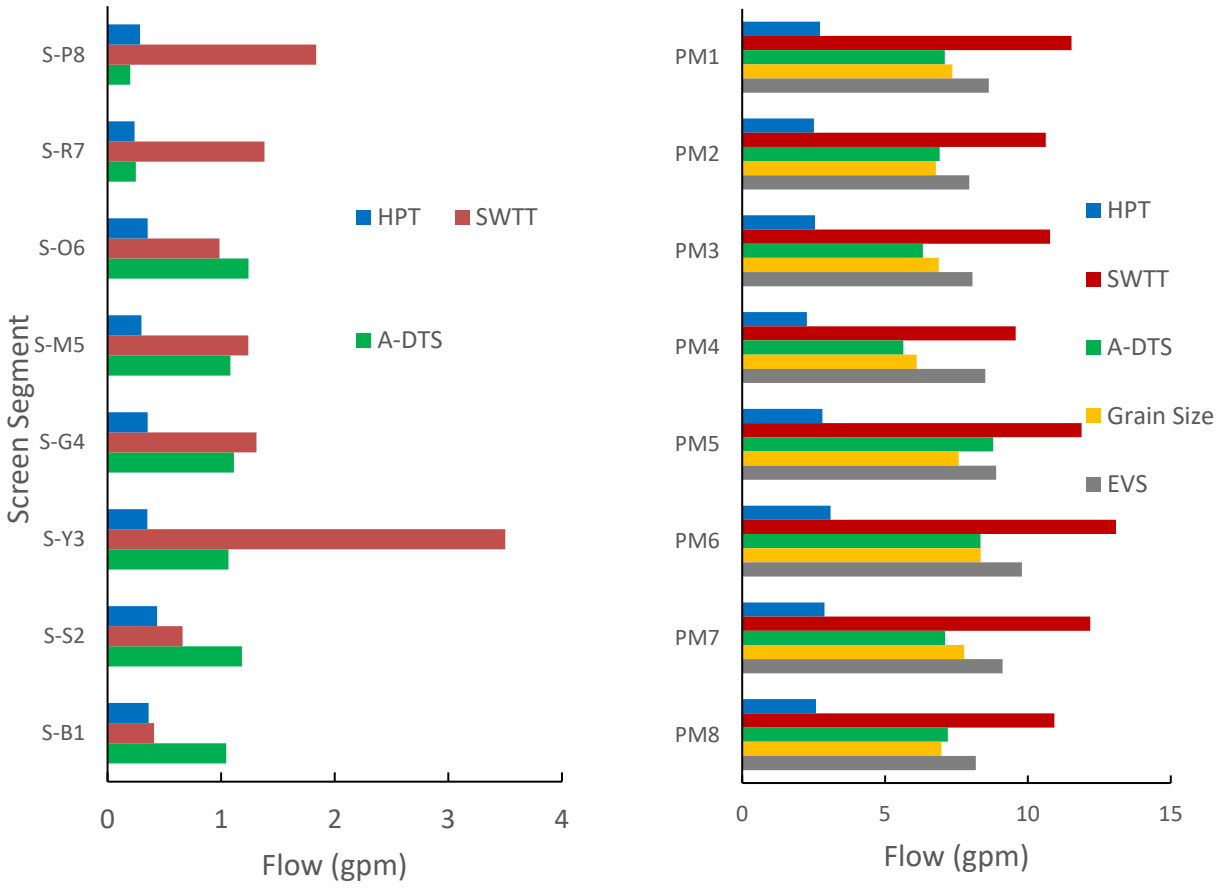



**Figure 33. Average Screen Segment Flows (left) for HPT, SWTT, and A-DTS, and Total Transact Calculated Flow for Each Performance Monitoring Event (PM1, PM2, etc.) for All Methods (right).**

The results for the DTS and SWT methods are similar for some screen segments and monitoring events, however, there are some screen segments where the SWTT method is up to twice as high as the DTS method. Based on the highly uniform K distribution at the site (Figure 34), it is unlikely that much higher permeability zones exist at those screens, and rather the SWTT method may be less reliable or biased high at these locations. In the Demonstration Plan (Divine et al. 2021c), it was proposed that success would be evaluated individually for each of the three methods and the performance objective would be considered to be achieved if:

- Repeated flux estimates for a specific method have an average relative percent difference (RPD) of <±25%.
- If through application of statistical analysis of variance, the result for a specific method agrees within 25% at an 80% confidence with the average of all methods.

If one method is determined to have failed, its result will be excluded from the average. For the relative standard deviation (RSD) for total transect flow across all eight monitoring events is similar, 14 and 10% for the DTS and SWTT methods, respectively. Because the HPT data are considered biased low, this second component of the success criteria cannot be evaluated as stated.

Generally, it is believed that some SWTT results for individual screens may be biased high because the low geologic heterogeneity would be expected to result in more uniform values across screen sections; however, conclusive data are not available requiring that the SWTT results be considered less reliable than the HPT results. Therefore, both methods are considered reliable and application of an averaging and complimentary approach likely results in the best estimate for the GAAF.

***Based on modified criteria, both the DTS and SWTT methods are considered to have achieved success for this performance objective.***

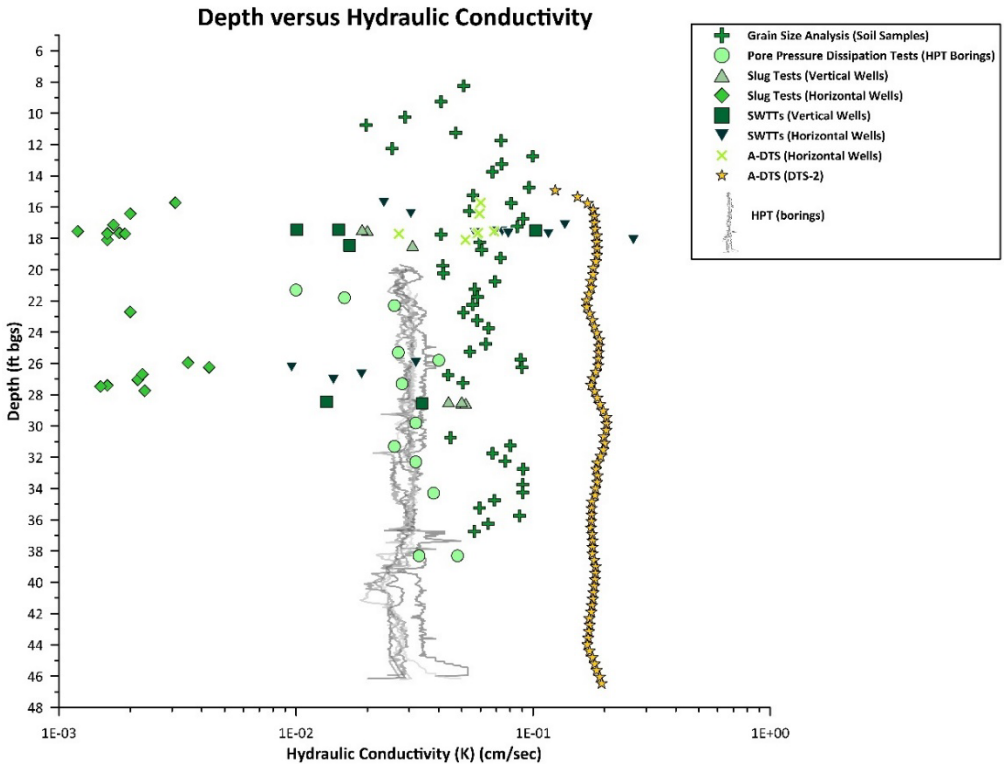



**Figure 34. Estimated K at the GAAF vs. Measurement Depth Comparing Multiple Methods**

*The majority of values fall between approximately 0.01 and 0.1 cm per second (30 and 300 ft/day).*

## 7.3 QUANTITATIVE PERFORMANCE OBJECTIVE 3: ASSESS COMPARABILITY OF SAMPLES COLLECTED FROM VWS SCREENS TO GRAB SAMPLES AND CONVENTIONAL MONITORING WELLS

This performance objective is intended to demonstrate that the groundwater samples collected from VWS screens are comparable to groundwater samples collected by conventional sampling methods commonly used in site characterization investigations, such as grab (e.g., VAP) samples obtained from direct-push drilling systems and samples from vertical monitoring wells. This performance objective was defined to confirm the overall representativeness of samples collected from the VWS and still accommodate irresolvable variances that may be the result of plume spatial variability caused by small-scale aquifer heterogeneity and flow system, and source variability and inherent differences in sampling methods.

### 7.3.1 Data Collected

Samples were collected quarterly from each individual screen in each VWS. These results were compared to nearby co-located groundwater samples from vertical borings and multilevel or conventional monitoring wells. These included one-time VAP grab samples collected as part of the prior ESTCP project at the GAAF (ER19-5203) and this ESTCP project. New multilevel and conventional wells installed during this project were also sampled multiple times. Sampling of these wells coincided sampling of the VWSs.

### 7.3.2 Data Interpretation

The high-resolution groundwater data generated from the previous ESTCP project at the site (completed in 2019) were evaluated to provide a basis for the success criteria for this performance objective. Numerous borings were installed previously, and VAP groundwater samples were collected from six to eight discrete intervals for each boring, generally between 15 and 50 feet below ground surface. Because the interval between 20 to 30 feet is the most important, the RSD of all samples collected from this interval was calculated for each boring. These results are shown in the left panel on Figure 35, below, and are plotted against the average concentration measured for the first year of quarterly monitoring. In general, RSD values range from less than 10% to more than 100% and appear to be independent of concentration magnitude. The average RSDs for PFOA and PFOS are 77 and 73%, respectively. Considering the uncertainty and limitations of the data, the average RPD for these data for the target interval is estimated to be 80%. This value was the basis for this performance objective.

The right panel of Figure 35, below, plots the RSD between samples from VWS and nearby VAP or vertical well samples. Figure 36, below, compares the average and range of samples collected from the VWS for the first four monitoring events to the closest VAP or vertical monitoring well. In general, sample results from the VWS are consistent with conventional sampling methods. The average RSDs for PFOA and PFOS are 59 and 62% (less than the goal of 80%), range from 1 to 182%, and appear to be independent of concentration magnitude.

***This comparison confirms the overall representativeness of samples collected from VWSs and the criteria for this performance objective are considered achieved.***

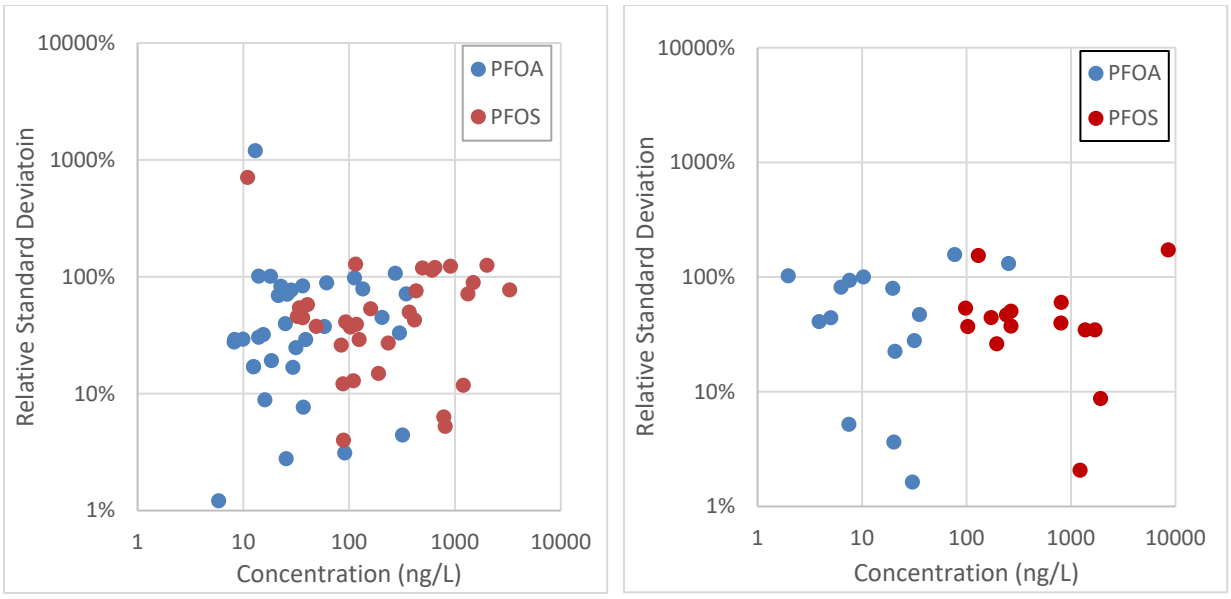



**Figure 35. RSD of all Groundwater Samples from the 20- to 30-foot Depth Interval**

*Left: RSD of previously collected groundwater grab samples to samples from the VWSs. Each point represents the results from one boring and is a measure of the variability of concentrations in the interval between 20 and 30 feet. Right: RSD between samples from VWS and nearby VAP or vertical well samples.*

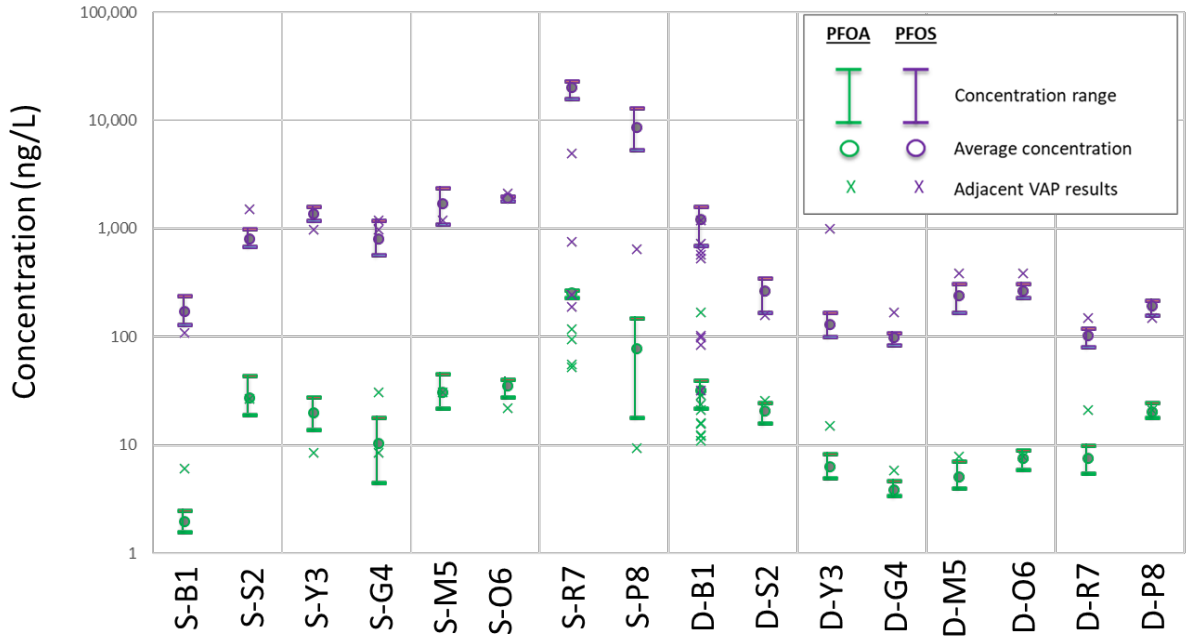



**Figure 36. Comparison of the Average (solid circles) and Range (horizontal bars) of Samples Collected from the VWS to the Closest VAP or Vertical Monitoring Well (x symbols).**

*Specific VWS screen identification names are noted on the x-axis.*

## 7.4 QUANTITATIVE PERFORMANCE OBJECTIVE 4: DEMONSTRATE METHOD TO IDENTIFY APPROPRIATE MASS FLUX ZONES TO TARGET VWS SCREEN PLACEMENT

Development of a low-cost screening method and/or a priori sampling data to identify target mass flux zones is critical to cost-effectively deploy the horizontal VWS transect or longsect wells to obtain maximum resolution and derive accurate mass discharge information. This performance objective is intended to assess the practical and cost-effective use of prior site information and pre-design vertical characterization data to design a VWS that is optimally placed and will yield reliable contaminant mass flux/discharge information.

### 7.4.1 Data Collected

Data used to support the assessment of this performance objective included all previously existing HPT and VAP groundwater grab sample concentration data as well as additional high-resolution data collected during the pre-design investigation (see Section 5.2). These data were incorporated into the existing 3-D site model (EVS model) used in a complimentary effort to design the placement locations of the VWSs (Figure 37). The VWSs were designed to yield mass discharge estimates that agree with the results from the EVS model which includes all other available site data. This evaluation is specifically considered in Performance Objective 5.

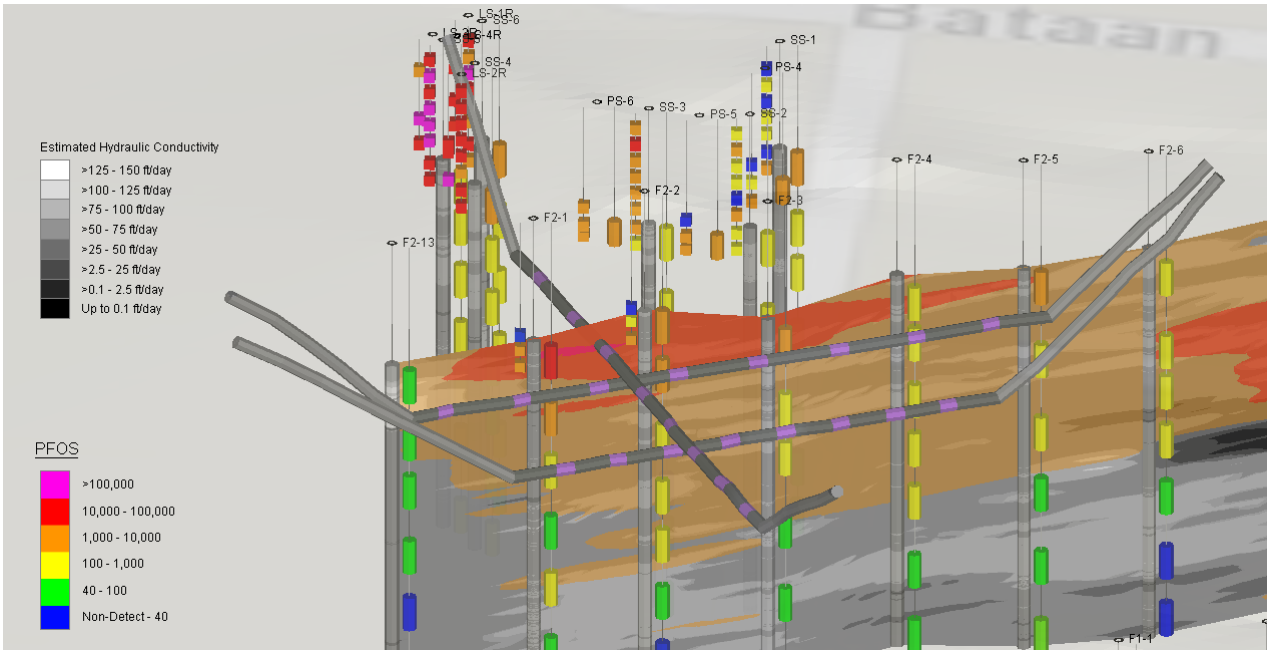



**Figure 37. 3-D Model Showing Design of the VWSs Based on Available Data. Hydraulic conductivity values are ft/day and PFOS concentrations values are ng/L.**

### 7.4.2 Data Interpretation

To understand the amount of pre-design data necessary to support a reliable design, a bootstrapping-type exercise was performed. PFOS mass discharge was calculated using all site data (i.e., 100% of data) and then some data were sequentially removed and PFOS mass discharge was recalculated.

The predicted mass discharge values from these alternate designs were calculated and compared. These results are shown in Figure 38. The y-axis represents the calculated PFOS mass discharge values for each model normalized to the value from the 100% model. This is a practical approach whereby a relationship between the amount of pre-design data available and the predicted mass discharge measured from the resulting VWS design can be developed. As seen in Figure 38, similar PFOS mass discharge values are estimated when 100, 90, 80, and 60% of all available data were used. More significant variation is observed when 40 and 20% of the data are used. This implies that more than enough pre-design data were available to support the VWS design. This performance objective is considered partially achieved because a clear relationship between data used and the calculated mass discharge was developed via a practical method. However, the analysis did not yield results that agreed within ±25% of the mass discharge estimated independently from the other available site data (e.g., on Figure 38, below, calculated relative mass discharge values between 0.75 and 1.25). The average results from the HPT, DTS, and SWTT methods yielded results of 1.4, 1.6, and 6 respectively. However, as discussed further in Performance Objective 5, the ±25% target is likely overly and unnecessarily optimistic given the geologic complexities and concentration variability. As such, this performance objective may still be considered achieved.

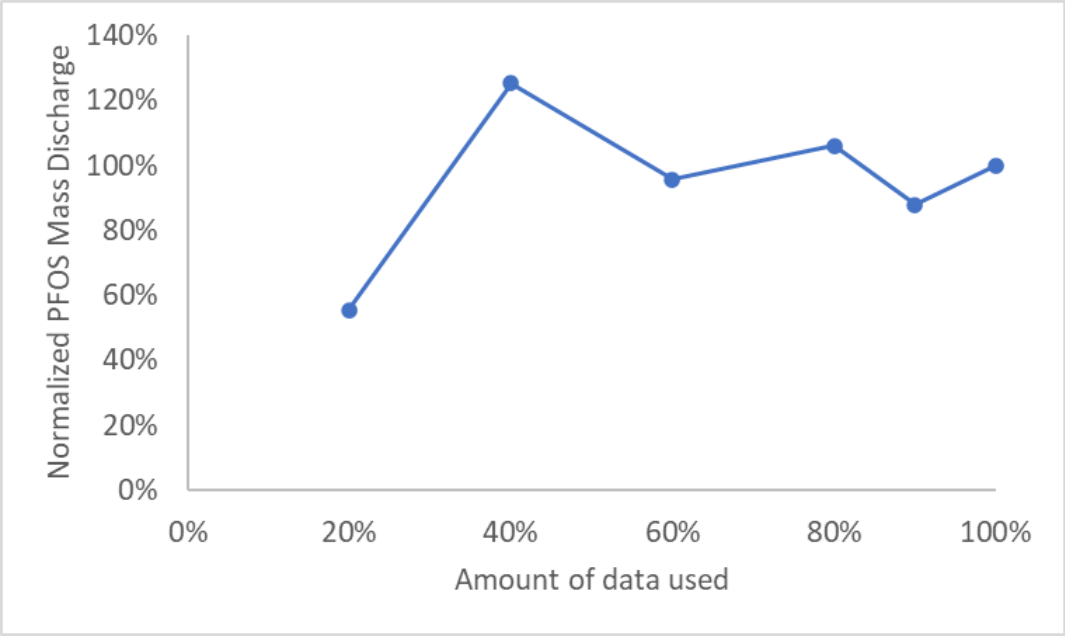



**Figure 38. Relationship between the Amount of Available Data used and Calculated PFOS Mass Discharge**

## 7.5 QUANTITATIVE PERFORMANCE OBJECTIVE 5: VALIDATE VWS APPLICATION FOR QUANTIFYING MASS FLUX/DISCHARGE ALONG TRANSECTS

This performance objective is intended to verify the reliability of using VWS transects to measure PFAS mass flux/discharge.

### 7.5.1 Data Collected

Mass flux/discharge normal to groundwater flow were calculated for the transect VWSs using groundwater samples collected from VWS well screens and the different measures of Darcy flux attributed to each of the screen zones (hydraulic testing, point-dilution tracer testing, A-DTS). These estimates were compared to mass discharges estimates developed from geostatistical modeling of hydraulic conductivity data from conventional vertical borings/wells installed along the same transect (most of these data were developed under prior ESTCP project ER19-5203 and were supplemented with new data collection) and PFAS concentrations measured in VWSs for each performance monitoring event. These analyses were completed in EVS and an example of the calculated PFOS mass flux distribution is shown on Figure 39, below (the hydraulic conductivity field is depicted in greyscale and the mass discharge distribution is depicted in color flood with the high values corresponding to warmer colors).

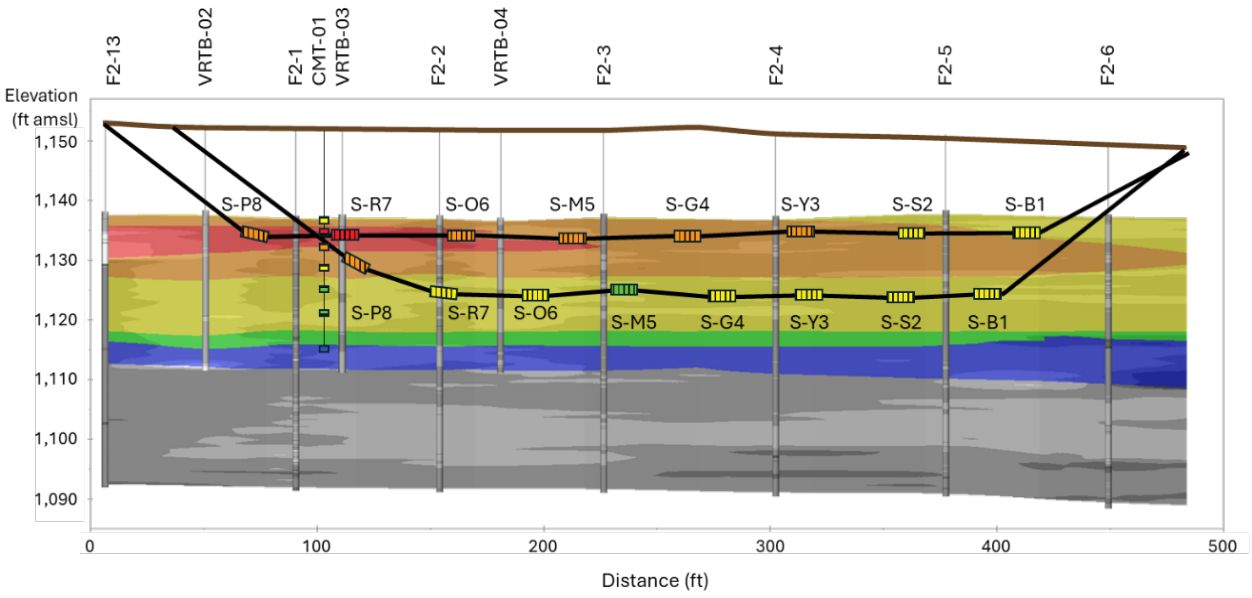



**Figure 39. Example EVS Calculated PFAS Mass Flux Distribution for Performance Monitoring Event #2**

### 7.5.2 Data Interpretation

The PFOS mass discharge estimates for each method and for each monitoring event are presented in Table 25, with average values ranging for the shallow-only transect from 58 to 326 mg/day (0.21 to 0.12 kg/year). In the Demonstration Plan (Divine et al. 2021c), it was proposed that success would be considered achieved if mass discharge estimates with VWSs agree with the conventional approach (using all data, including vertical borings/wells, in a geostatistical model [i.e. EVS])) within 25% at an 80% confidence.

**Table 25. Comparison of PFOS Mass Discharge (mg/day) for All Performance Monitoring Events.**

| Method | PM1 | PM2 | PM3 | PM4 | PM5 | PM6 | PM7 | PM8 | Average | RSD |
|---|---|---|---|---|---|---|---|---|---|---|
| **EVS** | 38 | 35 | 41 | 40 | 130 | 109 | 70 | 56 | 65 | 56% |
| **Grain Size** | 135 | 125 | 116 | 144 | 181 | 210 | 179 | 168 | 157 | 21% |
| **DTS** | 69 | 56 | 56 | 46 | 142 | 147 | 100 | 113 | 91 | 44% |
| **HPT** | 50 | 46 | 43 | 54 | 67 | 78 | 66 | 62 | 58 | 20% |
| **SWTT** | 279 | 257 | 238 | 309 | 382 | 431 | 367 | 344 | 326 | 20% |

Based on the first eight performance monitoring events, none of the methods meet this statistical level, and consequently, the criteria for this performance objective cannot be considered achieved as originally stated. However, given the complexity of subsurface characterization and PFAS transport, this may have been an unrealistic success criterion.

Although the EVS-based method utilizes the most site geological data it should not necessarily be considered the "gold standard" since its results are highly dependent on geostatistical parameter values and associated data interpolation. This method consistently yielded some of the lowest values, suggesting some other methods (especially SWTT) may provide estimates with a high bias. Regardless, the average results for both the HPT and A-DTS agree with the EVS result within a factor of 2, and all methods fall within a factor of 3 agreement envelope (see Figure 40). Furthermore, the event-to-event variability, as measured by the relative standard deviation (RSD) is similar for all of the methods (with EVS being the highest), ranging from 20 to 56%. This implies that the differences in methods are related more toward a systemic consistent bias rather than precision and repeatability. In practice, remediation decisions are not made from specific mass discharge values or single estimates, but rather from trends in mass discharge over time. As such, all methods appear to be reliable for this application. In most cases estimating mass discharge from several methods will increase confidence in estimated values and provide insight regarding uncertainty of the estimates. Overall, the results support the use of VWS for PFAS mass discharge estimation by multiple independent methods.

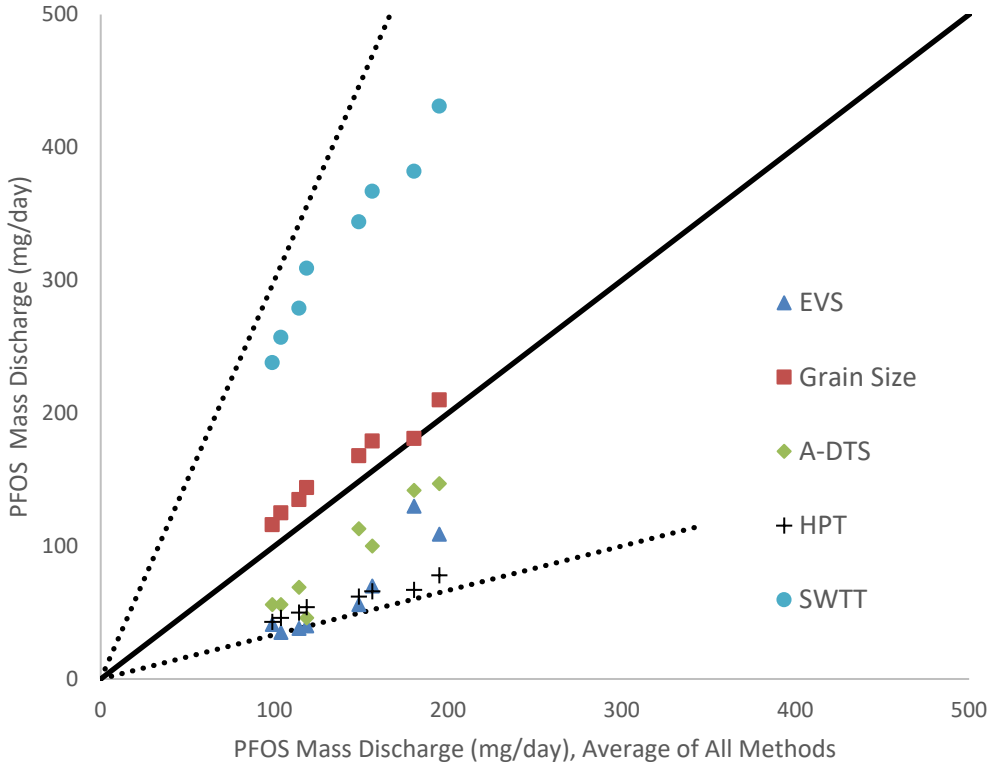



**Figure 40. Comparison of PFOS Mass Discharge Estimates for Each Performance Monitoring Event to the Average of All Methods for Each performance Monitoring Event.**

*The solid line represents 1:1 correlation and the dotted lines represent an agreement envelope of a factor of 3.*

## 7.6 QUANTITATIVE PERFORMANCE OBJECTIVE 6: VERIFY MATERIAL COMPATIBILITY WITH PER- AND POLYFLUOROALKYL SUBSTANCES

This performance objective is intended to demonstrate that the materials used in a VWS will not meaningfully affect measured PFAS concentrations in groundwater samples collected from a VWS. Other researchers (Denly et al. 2019; Rodowa et al. 2020) have evaluated the potential for cross-contaminant and positive sampling bias in a wide range of materials associated with groundwater sampling. These researchers have generally concluded that although Teflon™-containing materials (i.e., polytetrafluoroethylene) should be avoided, there is little contamination risk from most common materials including silicon, PVC, and low- and high-density polyethylene. This performance objective verified the expectation of PFAS compatibility based on previous published work and assessed the key components of the Vertebrate™ system that are in direct contact with sampled water.

### 7.6.1 Data Collected

As discussed in Section 5.3, laboratory-based experiments were completed and focused on key VWS components including the sock polyester geotextile screen wrap, HDPE screen, and HDPE riser tubing. Specifically, rinsate experiments (passing clean water over system components to document

no significant PFAS leaching) and soaking experiments (soaking key system components in a known PFAS solution to document no significant PFAS mass loss) were completed. The laboratory analytical results are summarized below.

During positive bias testing, only very low levels of PFOA (0.97 ng/L; this value is between the laboratory method detection limit and the laboratory practical quantitation limit) were detected in the rinsate sample from the geotextile screen wrap. This concentration is below the MCL of 4.0 ng/L for PFOA. PFAS was not detected in rinsate from any other system components. This very minor detect is not expected to meaningfully affect groundwater results at most sites. Nevertheless, another sample of geotextile was pre-washed with methanol and then solid phase laboratory analysis was then performed on the geotextile. No PFAS compounds were detected. Therefore, a simple methanol-based washing step can be implemented for the geotextile screen materials prior to use at PFAS sites.

A second set of tests were conducted to indirectly measure the potential for PFAS sorption to VWS well materials to affect sample results (i.e., cause a negative bias). The geotextile was soaked for 72 hours in a spike solution with very high PFAS concentrations (1,000 µg/L for all PFAS compounds analyzed). This is considered a reasonable soaking time because in common field settings, fresh groundwater is constantly entering the well and only remains in contact with the well materials for a few hours or days. The geotextile was then rinsed three times in deionized water and then analyzed for PFAS by solid phase analysis with methanol extraction, which is assumed to have recovered all PFAS mass that may have sorbed to the geotextile. Only three PFAS compounds were detected at low concentrations after the aggressive methanol extraction (Table 26). These results confirm some PFAS compounds did sorb to the well materials, however, the detections are very low compared to spike solution. Furthermore, the detected constituents are not significant contaminants at GAAF or many other AFFF sites. Therefore, the results suggest the mass adsorption over this period of time was insignificant and unlikely to affect groundwater sample results (i.e., create a negative bias).

**Table 26. Summary of Detections Material Compatibility Testing**

| | Positive Bias Testing | | Negative Bias testing | |
|---|---|---|---|---|
| **Compound** | **Geotextile rinsate** | **Geotextile washed with methanol** | **Spike Solution** | **Geotextile after soaking in spike solution** |
| PFOA | 0.97 *I* ng/L | <1.3 µg/kg | 1,000 µg/L | <1.3 µg/kg |
| FOSA | <0.95 ng/L | <1.3 µg/kg | 1,000 µg/L | 4.5 µg/kg |
| PFTeDA | <0.95 ng/L | <1.3 µg/kg | 1,000 µg/L | 47 µg/kg |
| PFTrDA | <0.95 ng/L | <1.3 µg/kg | 1,000 µg/L | 13 µg/kg |

*I* – The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit

### 7.6.2 Data Interpretation

The criteria for this performance objective are considered achieved. No obvious signs of positive or negative bias that would affect data usability have been identified. Based on the data collected in this study, the VWSs can be tested prior to production for certification to be free of primary PFAS-type analytes. It is believed that the well material cleaning process is unnecessary given the negligible amount of PFOA identified in the rinsate sample. However, the methanol rinsing protocol can still

be completed on future VWS installations to ensure VWS materials are PFAS free and will not bias groundwater sample results. In addition, sorption of PFAS to VWS materials was measured indirectly, and the results did not indicate the VWS materials are a significant sink for PFAS. ***Therefore, leaching and adsorption biases are not practical to consider as interference when using VWS and the criteria for this performance objective are considered achieved.***

## 7.7 QUALITATIVE PERFORMANCE OBJECTIVE 1: VWS CAN ASSESS CONTAMINANTS AND CONDITIONS ALONG THE FLOW PATH IN A LONGSECT CONFIGURATION

Both the absolute concentrations of PFAS species and their relative abundance (i.e., concentrations of individual PFAS species relative to each other) may change along the flow path due to PFAS transport and fate properties, geochemical conditions, and release/source mechanisms. A longsect VWS configuration that is oriented along a groundwater flow path orientation may be useful for assessing these conditions and monitoring changes through time. This performance objective is intended to assess the feasibility and usefulness of a longsect VWS configuration.

### 7.7.1 Data Collected

This performance objective was assessed using PFAS concentration data collected from the longsect VWS and compared to data along the flow path collected using vertical data collection methods (i.e., VAP samples and samples from multilevel and conventional wells).

### 7.7.2 Data Interpretation

An eight-screen 477-foot-long VWS was successfully installed in a longsect configuration along an inferred groundwater flow path from the source area near Building 1160 in a south-southeast direction (Figure 11, above). Success will be considered achieved if PFAS concentration data collected from different screen intervals located progressively downgradient follow discernable and consistent trends, indicating the samples represent locations along a flow path. Figure 41, below, shows the average PFOS and PFOA concentrations from the longsect VWS (closed circles series) and nearby VAP and conventional vertical monitoring wells (x series) plotted along the inferred flow path distance. In general, both the PFOS and PFOA data show consistency between the sampling methods and follow a general trend where the first several measurements are similar (approximately 1,100 to 2,400 ng/L for PFOS and 30 to 100 ng/L for PFOA) and then increase by more than 10 times for PFOS (up to 15,500 ng/L) and more than 5 times for PFOA (up to 228 ng/L) approximately 240 feet downgradient. Concentrations then decline somewhat at 275 and 310 feet downgradient.

Figure 42, below, shows the relative concentrations of primary PFAS species (as pie charts) along the inferred flow path distance. Consistently, PFOS, PFOA, and PFHxS are the three most significant PFAS species; however, their relative concentrations gradually change with distance. In a simple system, relative PFAS concentrations would be consistent along the flow path, and concentrations would be expected to be highest near the source (i.e., the first couple of samples along the longsect) with gradually declining concentrations along the flow path. However, imperfect alignment of the longsect with the flow path, temporally variable release history, complex precursor transformation processes, and the comingling contaminants from other sources may be influencing these data.

Currently, it is not possible to definitively conclude the responsible processes; however, the general consistency of VWS data with other sample types and the smoothness of the trend (i.e., high spatial correlation) suggest the well screens were located approximate along a common flow path and that VWS systems can be used to characterize contaminant concentrations in this way, and to assess contaminant transport processes along the flow path.

***As such, the success criteria for this performance objective are considered achieved.*** However, this application of VWSs will be more challenged at sites with significant geologic heterogeneity and variable flow direction.

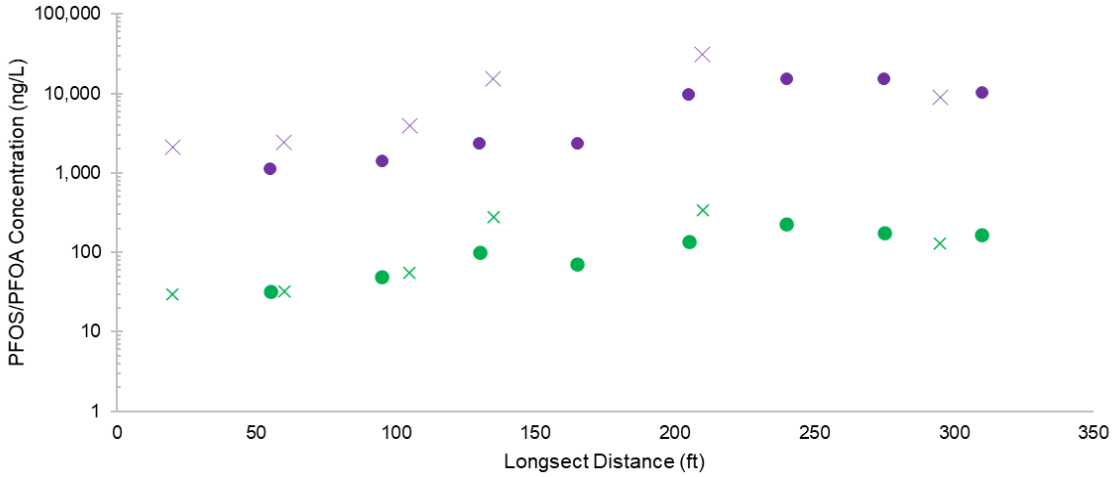



**Figure 41. Average Longsect VWS (circles) and Conventional Monitoring Well (x's) PFOS (purple) and PFOA (green) Concentrations**

One potential future application of a longsect VWS configuration involves evaluation of precursors to terminal PFAS along a flow path over time. Figure 43 presents the sum of target precursors (USEPA Method 1633) and the two most prevalent precursors in this dataset as a fraction of the sum of target PFAS (USEPA Method 1633) along the flow path. In order of frequency of occurrence, potential PFAS precursors detected using Method 1633 include 6:2-FTS, 8:2-fluorotelomer sulfonic acid (8:2-FTS), PFOSA, and 3:3-fluorotelomer carboxylic acid (3:3-FTCA). A decrease in the fraction of total PFAS precursors was observed at downgradient sample locations. A similar decrease was observed in the fractions of 8:2-FTS and to a lesser extent, 6:2-FTS. This observation may reflect biological transformation of precursor mass to terminal perfluoroalkyl carboxylic acids; FTSs are known biological precursors to short chain perfluoroalkyl carboxylic acids (LaFond et al., 2023). Additionally, the dominant precursor species changes from 8:2 FTS in the upgradient portion of the plume to 6:2 FTS downgradient. Differences in sorption characteristics are unlikely to account for the different transport behavior observed in these species based on published experimental organic carbon partitioning constant values and the sand nature of site soils. Also of note are sporadic detections of 3:3-FTCA, a potential degradation product of 4:2-FTS (Harding-Marjanovic et al., 2015), in downgradient locations. Distribution of precursor mass along the flow path may be influenced by production of these species from FTS-precursors and the relative rate of biological degradation of FTSs into FTCAs and ultimately perfluoroalkyl carboxylic acids.

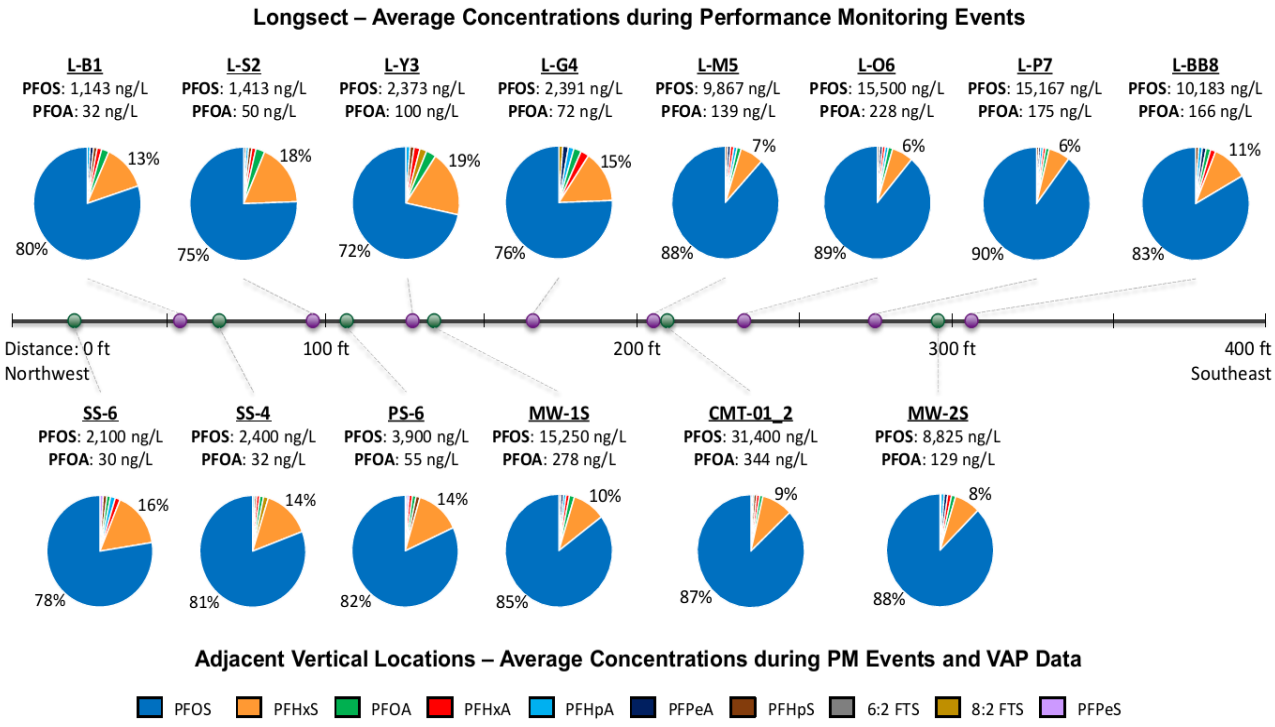



**Figure 42. Relative Concentrations of Primary PFAS Species Along the Inferred Flow Path Distance**

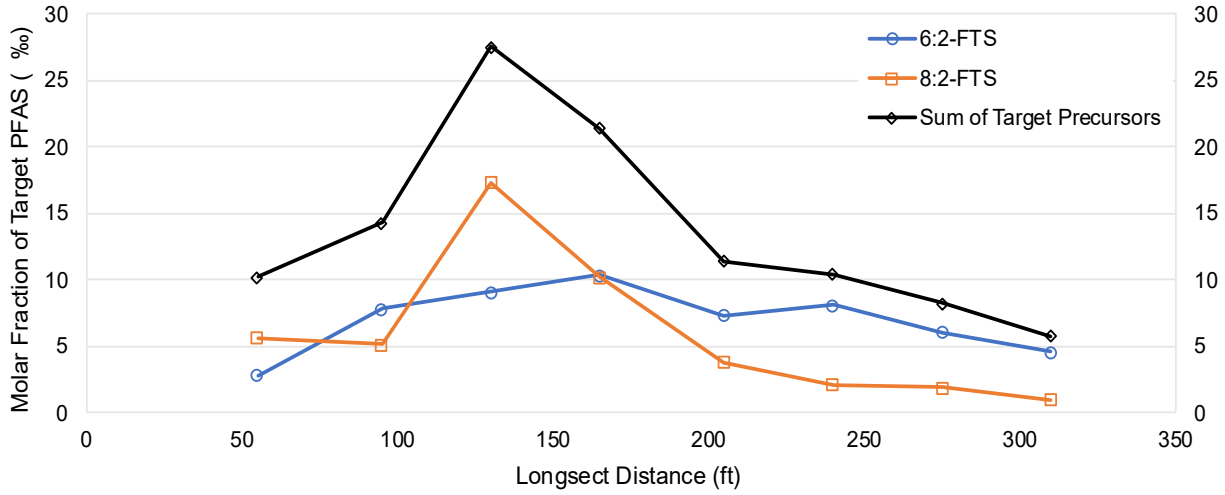



**Figure 43. Distribution of Target PFAS Precursors (6:2-FTS, 8:2-FTS, PFOSA, and 3:3-FTCA) Along the Inferred Flow Path Distance**

## 7.8 QUALITATIVE PERFORMANCE OBJECTIVE 2: DEMONSTRATE INTEGRITY OF GROUT SEALS TO ISOLATE INDIVIDUAL SCREEN SEGMENTS

This performance objective is intended to confirm the integrity of the grout seals separating each well screen segment of the VWS. Seal integrity prevents groundwater from short-circuiting along the well bore and is necessary for sample quality and reliability as well as reliability of hydraulic tests in the screen intervals.

### 7.8.1 Data Collected

Data from two independent methods were used to assess this performance objective:

- A pressure transducer was inserted in VWS screen segments and water was added to adjacent screen segments to detect pressure increases from hydraulic tests in adjacent well screens. No hydraulic response was noted in individual screen segments from pressure changes in adjacent screens.
- The A-DTS system was used to measure temperature under passive and active (heated) conditions from the well bore. Because the different well materials (e.g., grout seals, sediments) exhibit a contrast in thermal conductivity, the position and continuity of seals along the full VWS length were mappable. Thermal response could be quantified two ways: temperature above background during curing and apparent thermal conductivity from A-DTS test.

### 7.8.2 Data Interpretation

This performance criterion is considered successfully achieved based on the following:

- Pressure transducer data do not show clear evidence of seal failure or poor seal construction (e.g., immediate increase in pressure greater than 1 foot of head) during injection testing in adjacent screen intervals.
- The A-DTS data delineate continuous seals that are at least 5 feet long (mean 13 feet, maximum 20 feet) between the five horizontal screens for the shallow VWS.
- The integrity of the grout seals was confirmed for screens installed along the horizontal portion of the VWSs (13 of 18 seals). The grout intervals were difficult to quantify at each end due to screens on a slope and less precise grout injection.

***Overall, grout seals in the horizontal section appear to be placed where intended and are largely functioning as intended (hydraulic separation), as such, this performance objective is considered achieved.***

The shallow and deep VWSs each contained screens on a slope as part of this demonstration where an aggressive ascent angle was implemented to exit, for example, in front of the taxiway. Grout intrusion was observed in those screens based on field water quality parameters (mainly pH) measured during groundwater sampling. This is apparently the result of gravity flow of the grout toward the bottom of the bore. The ends of each bore are able to be grouted from the surface using a flow-down technique (pouring or pumping from the surface) and this was completed during installation.

However, due to this evidence of intrusion, this is only advised after the tremie and proper grouting in bore has been completed and set, and should be done with caution in applicable amounts.

In addition to grout seal issues on the slopes, locating accuracy decreases when drilling at an angle from horizontal as described in Section 7.1. Therefore, during future installations, it is recommended to avoid placing screens on slopes due to potential poor grout seals and decreased locating accuracy. For optimum installation, the bore is recommended to continue horizontally or extend beyond the first and last screens by 10 feet. Additional techniques are possible on a case by cases basis, such as introducing flowing sand on the end of bores and using other EN Rx techniques such as packers for prohibiting grout migration. However, these are not needed if the bore can be properly extended because the seal integrity throughout the horizontal portions of the bore was validated by the data collected.

## 7.9 QUALITATIVE PERFORMANCE OBJECTIVE 3: IDENTIFY CHALLENGES AND LIMITATIONS OF VWSS

This performance objective aims to gather existing practical site implementation and operational considerations to help guide the design of VWSs for monitoring PFAS mass flux/discharge for other sites. This performance criterion is considered successfully achieved because challenges and limitations are understood and can be readily mitigated.

### 7.9.1 Data Collected

Surveys from project personnel involved in installation and system operation, monitoring, sampling, and hydraulic testing were conducted to document implementation challenges or practical considerations throughout the project. Drilling and installation challenges were assessed based on site geologic and hydrogeologic conditions, and experience with the HDD required for the VWS installations.

### 7.9.2 Data Interpretation

This performance criterion is considered successfully achieved because no significant implementation or operational challenges are identified that would limit widespread application of the VWS technology at a broad range of AFFF PFAS sites. Lessons learned from this field demonstration include:

- Avoid installing screens at an angle:
  - Reduced ability to accurately determine placement during drilling
  - Increased risk of grout in screen.
- Limit entry/exit angles to prevent tight bends in the VWS.
- Irresolvable uncertainty in confirming as-built vertical borehole location results in a minimum target thickness of 1 to 1.5 feet.
- Grout delivery methods and options:
  - Concerns for a free-flowing annulus

  - Currently evaluating alternative methods such as a mechanical seal or other means to ensure more precise placement of grout seals.

- Well materials/construction significantly affect hydraulic test results.
- Understanding seasonal water table fluctuations will be important at PFAS sites due to the potential for PFAS to accumulate near the air-water interface. VWS screens installed in high-flux zones near the water table could become dry when groundwater levels decline.
- Although not unique to VWSs, environmental professionals unfamiliar with HDD should be aware that HDD can produce significant amounts of IDW. Considerations should be made for IDW storage and disposal during the planning stage. The following amounts of IDW were generated during this project:
  - *Solid waste*. Waste generated during installation of the VWSs consisted of a mixture of bentonite-based drilling fluid and soil cuttings that was stored in three 20-cubic yard open top roll-off boxes. The high liquid content drilling fluid waste was solidified with an absorbent material to allow disposal as a solid waste stream. The total weight of solidified material was 38 tons with a volume of approximately 45 cubic yards.
  - *Liquid waste*. A total of 2,125 gallons of water was pumped from the VWSs during well development and stored in a 20-cubic-yard vacuum box.

## 7.10 QUALITATIVE PERFORMANCE OBJECTIVE 4: ASSESS ROBUSTNESS OF THE TECHNOLOGY

This performance objective assesses robustness of VWS components to identify if there are design flaws or limitations that should be addressed before the VWS technology is applied at other AFFF PFAS sites.

### 7.10.1 Data Collected

Feedback was obtained from geologists and field staff regarding observed ruggedness and performance of screens, sampling ports, connections, and other well components. Responses included the following:

- The large flush-mount boxes used for this project are rugged and are recommended for future installations.
- Feeding sampling tubes can be challenging; dedicated tubing is recommended to simplify sampling.
- Specialty fittings are required for tracer and slug tests.
- Caps and labels for the individual risers are important for ensuring sample representativeness and proper sample IDs.
- Tight bends may inhibit flow and should be avoided where the well risers enter the well vaults.
- Total VWSs installed to date is more than 200.

- Based on discussion with drillers it may be possible to obtained geologic information after the pilot borehole has been installed using nuclear magnetic resonance imaging geophysical sonde that is pulled through the borehole (e.g., Spurlin et al., 2019). This could be used to confirm geologic interpretations before final VWS design and installation.

### 7.10.2 Data Interpretation

This performance criterion is considered successfully achieved. No fundamental design flaws/ limitations were identified and no systemic problems were experienced during installation and sampling. As of August 2023, more than 200 VWSs have been installed. Lessons learned from previous installations and this ESTCP project will be used to continue improving the design, installation, and sampling processes.

# 8.0 COST ASSESSMENT

This section is intended to provide sufficient cost information such that a remediation professional can reasonably estimate costs for installation of VWSs at a site. In addition, a cost benefit analysis is presented that compares the costs of VWS to a transect of conventional vertical monitoring wells.

## 8.1 COST MODEL

All costs associated with design, installation, and monitoring of VWSs were tracked during the demonstration project. A simple cost model is presented in Table 27, below, and serves as general guidance for estimating the costs of installing VWSs. The costs include:

- Pre-design characterization (see Section 5.2):
  - Five HPT borings
  - Five VAP borings
  - Four vertical fiber optic cables
  - One MLS with seven screens
  - Five conventional monitoring wells.

- VWS materials and installation (see Section 5.4):
  - Three VWSs with total length of 1,390 feet
  - One stand-alone horizontal fiber optic cable
  - Eight screens per VWS for a total of 24 screens
  - Well development
  - Waste disposal
  - Three weeks in the field.

- Performance monitoring and data analysis (see Section 5.6):
  - Twenty-four samples from the VWSs
  - Seven samples from the MLS
  - Five samples from the conventional monitoring wells
  - A-DTS data acquisition.

**Table 27. Cost Model for Three VWSs**

| Cost Element – VWS | Data Tracked During the Demonstration | Unit Cost | Unit | Quantity | Cost |
|---|---|---|---|---|---|
| Pre-design characterization | Labor and equipment costs. | $50,000 | Lump sum | 1 | $50,000 |
| | Drilling subcontractor costs. | $50,000 | Lump sum | 1 | $50,000 |
| | Laboratory costs. | $28,000 | Lump sum | 1 | $28,000 |
| **Subtotal: Pre-Design Characterization** | | | | | **$128,000** |
| Materials: VWS components | Three VWSs with total length of 1,390 feet. | $103,000 | Lump sum | 1 | $103,000 |
| | Risers and grout lines: 0.75-inch HDPE. | | | | |
| | Well screens: 1-inch-diameter HDPE with geotextile screen. Eight screens per system for total of 24 screens. | | | | |
| | A-DTS fiber optic cables. | | | | |
| | Tracer wire: copper clad steel wire. | | | | |
| Installation of VWSs | Utility locating and surveying. | $105,000 | Lump sum | 1 | $105,000 |
| | Drilling equipment mobilization. | | | | |
| | Drilling, reaming, and well installation. | | | | |
| | Well development. | | | | |
| | Grout wells seals. | | | | |
| | Flush-mount vaults. | | | | |
| Waste disposal | Waste characterization: analytical costs. | $3,000 | Lump sum | 1 | $3,000 |
| | Solid and liquid waste disposal: container rental, transportation, and disposal | $30,000 | Lump sum | 1 | $30,000 |
| **Subtotal: VWSs** | | | | | **$241,000** |
| Monitoring | Groundwater sampling and hydraulic testing. | $15,000 | Per event | 8 | $120,000 |
| | A-DTS data acquisition: per monitoring event. | $9,000 | Per event | 8 | $72,000 |
| | Laboratory costs. | $8,000 | Per event | 8 | $64,000 |
| | Flux analysis and 3-D modeling: per monitoring event. | $5,000 | Per event | 8 | $40,000 |
| **Subtotal: Performance Monitoring** | | | | | **$296,000** |

The costs unique to the VWS are the well materials, with most components made of HDPE. For a typical VWS, the well materials will be roughly 50% of the installation costs (excluding waste disposal). The cost of well materials have risen during the last couple of years due to high inflation rates and global supply chain issues. It is difficult to predict how material costs will change in the coming years.

## 8.2 COST DRIVERS

Most remediation professionals are already familiar with the primary factors that influence vertical drilling costs. Most of these same factors also influence costs associated with the HDD method used to install VWSs. There are many variables that impact VWS installation costs and each design is customized based on the objectives of the given project. The main cost drivers of the VWS technology are summarized below:

- *Number of VWSs*. Unit costs for installation of one VWS will be higher due to costs of mobilizing the directional drilling rig and associated equipment. The unit costs decrease when installing multiple VWSs, because the mobilization costs are spread across multiple VWSs.
- *Number of VWS segments and diameter*. A larger number of segments causes the costs to increase in several ways. These include higher cost of well materials (dedicated riser and grout lines to each screen), additional time installing grout seals between the segments, more well development effort, and higher waste disposal costs due to the larger volume of liquid waste produced. The number of segments impact the diameter of the bore; therefore, also increasing drilling costs and drilling waste material costs. Standard VWSs are installed using a 3- or 4-inch-diameter sleeve; therefore, the borehole diameter is fixed. However, if a larger diameter sleeve is used to accommodate more screen intervals/risers, this would increase directional drilling, materials, and waste disposal costs.
- *VWS length and depth*. Well length and depth have a significant impact on the overall installation costs. As length and depth increase, so do the directional drilling and materials costs. Further, the waste disposal costs have a direct relationship to these design parameters due to the larger volume of drilling waste generated during drilling and reaming operations. Usually, the length is a major factor in determining the number of segments and these factors increase together; however, the threshold for larger bores and limitation of length play a part in minimizing cost.
- *Lithology*. Difficult drilling conditions such as dense soils and cobbles result in higher directional drilling costs. Coarser grained formations that are prone to flowing sand conditions and resultant borehole instability will also cause costs to increase. Drilling through bedrock is significantly more costly. These drilling conditions also have consistent cost impact when applying various vertical drilling methodologies that are available for conventional vertical monitoring wells.
- *HDD navigation*. A walkover locating system was used during installation of the VWSs. This locating technology is most often used during HDD. At some project sites, walkover locating may not be applicable due to electromagnetic interference, lack of access above the drill head, or drilling depth greater than approximately 70 feet. Expanded features for walkover tools have reduced the interference, and features like drill-to-box allow some avoidance of common interference; however, at some sites interference can require alternatives.

In these cases, a wireline navigation system would be required. Wireline locating systems include remote magnetic system and gyroscopic steering tools, which are more expensive than the walkover system used for this project. For reference a gyroscopic steering tool would add approximately $6,000 per day while drilling the pilot bore.

## 8.3 COST ANALYSIS

The specific requirements, scale, and geometry of each application will vary. However, product capabilities and limitations can provide a typical application scenario and scalability when examining the cost. To start, drilling speed in typical lithologies is approximately 300 to 400 ft/day. A 300- to 400-foot well system can generally be installed in 2 days (1 day for drilling and 1 day for installation and development). Well systems significantly shorter than 300 feet cannot necessarily be installed in considerably less time, and cost per foot increases appreciably. From this point of 300 feet or greater to the maximum length of typical sleeve sizes (800 to 1,200 feet), the costs are approximately linear. Beyond this distance, rig sizes and sleeve changes increase costs significantly. Also, the well screen spacing and screen length are proportional to the plume width and at these typical spacing distances are practical and only marginal, and linear cost increases are experienced over the total distance. Listed below is a typical and scalable design:

- A site with sandy to silty soils with a water table depth of 10 feet.
- Two transect systems, each 500 feet long with a 10-well screen.
- Risers (¾ inch) for probe and tracer access, with a 4-inch sleeve.
- A 20-foot installation depth, with little to no interference for locating tools.
- Two systems installed with 1,000 feet total of drilling, providing either stacked or multiple transect positions. A total of 20 well screen positions.
- Standard vaults and finishing requirements.
- Traditional drilling, with no rock or other obstructions, and standard drilling mud blends.
- Mobilization of drilling equipment within the region (5 hours or less).
- Includes light mobilization, freight of well system to the central U.S., drilling, and installation.

Based on the model presented in Section 8.1, the estimated drilling and materials cost (for two 500-foot-long VWSs) is approximately $150,000. Note that this analysis does not include oversight, IDW disposal, and sampling costs because these costs vary and depend on site conditions and objectives.

The VWS was designed and invented for its ability to access difficult areas of a site. It is practical to install VWSs with minimal redesign or speeds/installation changes based on surface obstacles (e.g., building, flight line). Minor reorientation of the bore path in the field is common but does not add considerable costs.

# 9.0 IMPLEMENTATION CONSIDERATIONS

VWSs are most advantageous for poorly accessible plumes. The subsurface zones beneath buildings, flight lines, and other obstructions (including natural obstructions, such as ponds or forested areas) can be accessed from alternate surface positions using this technology. However, for optimal design and to maximize the performance of this technology, the following pre-qualifications and considerations are suggested:

- The concentrations and lithology of the plume should be well-understood. The lithology should be understood at the beginning and end of the bore to the final depth. High-resolution site characterization data are recommended for all installations.
- Previous penetrations, well installations, and other vertical environmental equipment should be considered obstacles for the VWS installation. Some previous installations may be suitable for abandonment prior to installation. A buffer distance between the VWS and previous penetrations are recommended at 5 feet or greater. Redevelopment of vertical environmental wells may be required where horizontal drilling encroaches.
- Any anomalies encountered along the length can cause difficult drilling conditions. Research into historical backfilling is recommended for shallower installations.
- Depths shallower than 3 feet may cause difficulty with drilling fluid continuity. Drill fluid surfacing is possible in these shallow settings, especially where other investigative penetrations exist or other utilities allow a pathway to the surface. Often, drilling techniques can regain fluid circulation but time and cost may increase in these settings.
- Depths greater than 60 feet may require additional setbacks and larger drilling equipment. Depths greater than 100 feet likely will require additional specialized tracking equipment.
- Site logistics should be considered. Typically, a minimum of two vehicles (drill rig support truck and vac trailer) are required near the entry position. To access the plume, the entry point can be in any direction from the intended transverse; however, a setback of 3:1 or greater is needed. Also required is space for temporary IDW storage. IDW storage and crew vehicle parking can exist at alternate locations on site.
- An appropriate exit location minimizes installation cost and site time. If an appropriate exit cannot be located, a dead-end bore can be completed for installation. The exit location should have a distance of 3:1 from the depth and end of the last screen position.
- Utilities at the beginning and the end of the bore must be properly marked and at known depths anywhere the depth of the bore is less than 10 to 15 feet. A site walk is recommended prior to design to ensure these utilities can be avoided with direction and depth adjustments.
- Walkover electromagnetic drill bit locating is used along the entire bore length; however, interference often exists inside buildings and other obstacles. Varying the frequencies of the tracking equipment can manage interference. A site walk before design can assess the amount of interference that may be encountered.
- VWSs are custom built and generally require 4 to 8 weeks of processing, construction, and shipping.

- Maintenance of VWSs is similar to that of vertical monitoring wells. VWSs should be protected at the surface with flush mount vaults or protective stickup casings. The risers should be capped to maintain surface integrity. These features should be inspected during each sampling event and repaired if needed. If silting or fouling were to occur, purging and chemical additives can be used to remove scale or biofouling. This has been very rare and only occurred at one site where chemical precipitates resulted from remedial injection reactions. These VWSs were successfully rehabilitated using standard well development methods.
- VWSs are abandoned by grouting in place. Each VWS segment is filled with the proper volume of grout to ensure grout reaches the end of the screen. The risers are then cut off at the surface. It is not practical to abandon the VWS by removal via over drilling. In addition, the tensile strength of the risers is too low to allow extraction of the well materials.

# 10.0 REFERENCES


Acar, O. H., Klammler, K. Hatfield, M. Newman, M. Annable, J. Cho, B.L. Parker, J.A. Cherry, P. Pehme, P. Quinn, and R. Kroeker. 2013. A stochastic model for estimating groundwater and contaminant discharges from fractured rock passive flux meter measurements. Water Resources Research 49(3):1277-1291. DOI:10.1002/wrcr.20109.

Adamson, D.T., A. Nickerson, P.R. Kulkarni, C.P. Higgins, J. Popovic, J. Field, A. Rodowa, C. Newell, P. DeBlanc, J.J. Kornuc. 2020. Mass-Based, Field-Scale Demonstration of PFAS Retention within AFFF-Associated Source Areas. Environmental Science & Technology, 54, 15768–15777. DOI: 10.1021/acs.est.0c04472

AECOM. 2018. FINAL PFAS Preliminary Assessment Report, Camp Grayling, Michigan. August.

AECOM. 2019. Draft Site Inspection, Section 2, Background, Camp Grayling, Michigan.

AMEC Foster Wheeler. 2017. PFCs Investigation – Camp Grayling Airfield, Grayling, Michigan. September.

Anderson, R.H. 2021. The Case for Direct Measures of Soil-to-Groundwater Contaminant Mass Discharge at AFFF-Impacted Sites. Environmental Science & Technology Article ASAP. DOI: 10.1021/acs.est.1c01543 ES&T.

Annable, M.D., Hatfield, K., Cho, J., Klammler, H., Parker, B. L., Cherry, J. A., Rao, P.S.C. 2005. Field-scale evaluation of the passive flux meter for simultaneous measurement of groundwater and contaminant fluxes. Environmental Science & Technology, 39(18), 7194-7201.

Arcadis. 2017. Air Force Civil Engineer Center "Stratigraphic Flux – A Method for Determining Preferential Pathways for Complex Sites, BAA ID 967, FA8903-15-C-0007. August.

Arcadis. 2020. Draft Site Demonstration Report Validation of Streamlined Mobile Lab-Based Real Time PFAS Analytical Methods. ESTCP Project ER19-5203.

Bakker, M., R. Caljé, F. Schaars, K. van der Made, and S. de Haas. 2015. An active heat tracer experiment to determine groundwater velocities using fiber optic cables installed with direct push equipment. Water Resources Research 51, 2760–2772. DOI:10.1002/2014WR016632.

Bakx, W., P.J. Doornenbal, R.J. Van Weesep, V.F. Bense, G.H.P. Oude Essink, and M.F.P. Bierkens. 2019. Determining the Relation between Groundwater Flow Velocities and Measured Temperature Differences Using Active Heating-Distributed Temperature Sensing. Water 11, 1619. DOI: 10.3390/w11081619

Béland-Pelletier, C., M. Fraser, J. Barker, and T. Ptak. 2011. Estimating contaminant mass discharge: A field comparison of the multilevel point measurement and the integral pumping investigation approaches and their uncertainties. Journal of Contaminant Hydrology 122, 63–75. DOI: 10.1016/j.jconhyd.2010.11.004

Carslaw, H. S., and J.C. Jaeger. 1959. Conduction of heat in solids (2nd ed.). Oxford: Oxford University Press.

Coleman, T.I., B.L. Parker, C.H. Maldaner, and M.J. Mondanos. 2015. Groundwater flow characterization in a fractured bedrock aquifer using active DTS tests in sealed boreholes. Journal of Hydrology 528: 449-462.

Cormican, A., J.F. Devlin, and C. Divine. 2020. Grain Size Analysis and Permeametry for Estimating Hydraulic Conductivity in Engineered Porous Media. Groundwater Monitoring and Remediation, 40, 65–72.

Denly, E., J. Occhialini, P. Bassignane, M. Eberle, and N. Rabah. 2019. Per- and polyfluoroakyl substances in environmental sampling products: Fact or fiction? Remediation, 29:65-76. DOI: 10.1002/rem.21614.

des Tombe, B.F., M. Bakker, F. Smits, F. Schaars, and K. Made. 2019. Estimation of the Variation in Specific Discharge Over Large Depth Using Distributed Temperature Sensing (DTS) Measurements of the Heat Pulse Response. Water Resources Research 55, 811–826. DOI: 10.1029/2018WR024171.

Devlin, J.F. 2015. HydrogeoSieveXL: an Excel-based tool to estimate hydraulic conductivity from grain-size analysis. Hydrogeology Journal, 23, 837–844.

Devlin, J.F., and P.C. Schillig. 2017. HydrogeoEstimatorXL: an Excel-based tool for estimating hydraulic gradient magnitude and direction. Hydrogeology Journal 25, 867–875. DOI: 10.1007/s10040-016-1518-4.

Divine, C.E., J. Wright, J. Wang, J. McDonough, M. Kladias, M. Crimi, B.N. Nzeribe, J.F. Devlin, M. Lubrecht, D. Ombalski, B. Hodge, H. Voscott, and K. Gerber. 2018a. The Horizontal Reactive Media Treatment Well (HRX Well®) for Passive In Situ Remediation: Design, Implementation, and Sustainability Considerations. Remediation, 28:5-16.

Divine, C.E., T. Roth, M. Crimi, A.C. DiMarco, M. Spurlin, J. Gillow, and G. Leone. 2018b. The Horizontal Reactive Media Treatment Well (HRX Well®) for Passive In-Situ Remediation. Groundwater Monitoring & Remediation, 38(1): 56-65.

Divine, C., J. Wright, P. Curry, P. Parker, S. Chapman, C. Maldaner, R. Robinson, and S. Koenigsberg. 2021a. Site Selection Memorandum: Vertebrae™ Segmented Horizontal Wells for Monitoring Contaminant Mass Discharge. ESTCP Project ER20-5026. January.

Divine, C., J. Wright, P. Curry, P. Parker, S. Chapman, C. Maldaner, R. Robinson, and S. Koenigsberg. 2021b. Go/No-Go Decision Recommendation: Vertebrae™ Segmented Horizontal Wells for Monitoring Contaminant Mass Discharge. ESTCP Project ER20-5026. March.

Divine, C., K. Hasbrouck, J. Wright, P. Curry, B. Parker, S. Chapman, C. Maldaner, J. Munn, L. Robinson, and S. Koenigsberg. 2021c. Draft Demonstration Plan, Vertebrae™ Segmented Horizontal Wells for Monitoring PFAS Mass Discharge. Version #2. September.

Divine, C., A. Wadhawan, V. Pulikkal, P. Khambhammettu, and J. Erickson. 2023. PFAS Requiring A Renewed Focus on Groundwater-Surface Water Interactions. Groundwater Monitoring & Remediation, 43(1): 14-31. https://doi.org/10.1111/gwmr.12569.

Drost, W., D. Klotz, A. Koch, H. Moser, F. Neumaier, and W. Rauert, 1968. Point dilution methods of investigating ground water flow by means of radioisotope. Water Resources Research, 4(1), 125-146.

Einarson, M.D., and J.A. Cherry. 2002. A New Multilevel Ground Water Monitoring System Using Multichannel Tubing. Groundwater Monitoring & Remediation 22, 52–65.

Einarson, M.D., D.M. Mackay, and P.J. Bennett. 2010. Sampling Transects for Affordable, High-Resolution Plume Characterization and Monitoring. Ground Water, 48(6), 805-808.

Einarson, M.D. 2017. Spatially averaged, flow-weighted concentrations – a more relevant regulatory metric for groundwater cleanup. Groundwater Monitoring & Remediation, 37(4), 11-14.

Gaspar, E., and M. Oncescu. 1972. Radioactive tracer in hydrology. Elsevier Publishing Company, Amsterdam.

Goltz, M.N., S.J. Kim, H. Yoon, J.B. Park. 2007. Review of groundwater contaminant mass flux measurement. Environmental Engineering Research 12, 176–193. https://doi.org/10.4491/eer.2007.12.4.176.

Grisak, G.E., W.F. Merritt, and D.W. Williams. 1977. A fluoride borehole dilution apparatus for groundwater velocity measurements. Can. Geotech J., 14, 554-561.

Guilbeault, M.A., B.L. Parker, and J.A. Cherry. 2005. Mass and flux distributions from DNAPL zones in sandy aquifers. Groundwater, 43(1), 70-86.

Hall, S.H. 1993. Single-well tracer tests in aquifer characterization. Ground Water Monitoring & Remediation, 13(2): 118-124.

Harding-Marjanovic, K., E. Houtz, S. Yi, J. Field, D. Sedlak, and L. Alvarez-Cohen. 2015. Aerobic Biotransformation of Fluorotelomer Thioether Amido Sulfonate (Lodyne™) in AFFF-Amended Microcosms. Environmental Science and Technology, 49(13): 7666-7674.

Horneman, A., C. Divine, T. Santangelo-Dreiling, S. Lloyd, H. Anderson, M.B. Smith, and J. McCray. 2017. The Case for Flux-Based Remedial Performance Monitoring Programs. Groundwater Monitoring & Remediation, 37(3): 16-18.

Horst, J., C. Divine, J. Quinnan, J. Lang, E. Carter, T. Guillette, and V. Pulikkal. 2022. Where is the PFAS? Innovations in PFAS detection and characterization. Ground Water Monitoring & Remediation, 42: 13-23, doi: 10.1111/gwmr.12502.

ITRC. 2010. Use and Measurement of Mass Flux and Mass Discharge. MASSFLUX-1. Washington, D.C.: Interstate Technology & Regulatory Council, Integrated DNAPL Site Strategy Team. www.itrcweb.org.

Johnson, R.L., C.N. Brow, R.O. Johnson, and H.M. Simon. 2013. Cryogenic Core Collection and Preservation of Subsurface Samples for Biomolecular Analysis. Groundwater Monitoring and Remediation 33, 38–43. https://doi.org/10.1111/j.1745-6592.2012.01424.x.

Kearney, K.J., T. Blount, E. Palmer, R. Arvizu, R. Sanford, A. Valocchi, C. Schaefer, and C.J. Werth. 2024. Assessment of cryogenic coring to preserve vertical distributions of

trichloroethylene and reaction products in an aquitard. Groundwater Monitoring Rem gwmr.12628. DOI: 10.1111/gwmr.12628.

Kiaalhosseini, S., R.L. Johnson, R.C. Rogers, M.I. Renno, M. Lyverse, and T.C. Sale. 2016. Cryogenic Core Collection (C 3) from Unconsolidated Subsurface Media. Groundwater Monitoring and Remediation 36, 41–49. https://doi.org/10.1111/gwmr.12186.

Klammler, H., K. Hatfield, M.D. Annable, E. Agyei, B.L. Parker, J.A. Cherry, and P.S.C. Rao. 2007. General analytical treatment of the flow field relevant to the interpretation of passive fluxmeter measurements. Water Resources Research, 43, W04407.

Klammler, H., K. Hatfield, M.A. Newman, J. Cho, M.D. Annable, B.L. Parker, J.A. Cherry, and I. Perminova. 2016. A new device for characterizing fracture networks and measuring groundwater and contaminant fluxes in fractured rock aquifers, Water Resources Research, 52: 5400–5420.

Koenigsberg, S.S., E.R. Piatt, and L.I. Robinson. 2018. New perspectives in the use of horizontal wells for assessment and remediation. Remediation, 28:45–50. https://doi.org/10.1002/rem.21575.

LaFond, J., P. Hatzinger, J. Guelfo, K. Millerick, and W.A. Jackson. 2023. Bacterial transformation of per- and poly-fluoroalkyl substances: a review for the field of bioremediation. Environmental Science: Advances, 2: 1019-1041.

Laton, W.R. 2019. New perspectives on horizontal to vertical well ratios for site cleanup. Remediation, 30:27-31, DOI: 10.1002/rem.21628.

Lubrecht, M.D. 2012. Horizontal directional drilling: A Green and sustainable technology for site remediation. Environmental Science & Technology, 46: 2484-2489.

Maldaner, C., J. Munn, T. Coleman, J. Molson, and B.L. Parker. 2019. Groundwater flow quantification in fractured rock boreholes using active distributed temperature sensing under natural gradient conditions. Water Resources Research, 55(4), 3285-3306.

McCall, W., and T.M. Christy. 2020. The Hydraulic Profiling Tool for Hydrogeologic Investigation of Unconsolidated Formations. Groundwater Monitoring and Remediation, 40, 89–103.

Molson, J.W., Frind, E.O., Palmer, C., 1992, Thermal energy storage in an unconfined aquifer 2. Model development, validation and application, Water Resources Research, 28(10), 2857-2867

Munn, J., C. Maldaner, and B. Parker. 2020. Measuring fracture flow changes in a bedrock aquifer due to open hole and pumped conditions using Active Distributed Temperature Sensing. Water Resources Research, DOI:10.1029/2020WR027229.

Nickerson, A., A.C. Maizel, P.R. Kulkarni, D.T. Adamson, J.J. Kornuc, and C.P. Higgins. 2020. Enhanced Extraction of AFFF-Associated PFASs from Source Zone Soils. Environmental Science & Technology 54, 4952–4962. DOI: 10.1021/acs.est.0c00792.

Rodowa, A.E., C. Emerson, J. Sedlak, G.F. Peaslee, D. Bogdan, and B. DiGuiseppi. 2020. Field Sampling Materials Unlikely Source of Contamination for Perfluoroalkyl and Polyfluoroalkyl Substances in Field Samples. Environmental Science & Technology Letters 7(3): 156-163 Env. Sci. & Technol. Letters, DOI: 10.1021/acs.estlett.0c00036.

SERDP and ESTCP. 2018. Summary Report: SERDP and ESTCP Workshop on Research and Development Needs for Chlorinated Solvents in Groundwater. October 2018.

SERDP and ESTCP. 2022. Summary Report: SERDP and ESTCP Workshop on Research and Development Needs for PFAS in the Environment. October 20.

Simon, N., O. Bour, N. Lavenant, G. Porel, B. Nauleau, B. Pouladi, and L. Longuevergne. 2020. A comparison of different methods to estimate the effective spatial resolution of FO-DTS measurements achieved during sandbox experiments. Sensors, 20(2), 570. https://www.mdpi.com/1424-8220/20/2/570.

Spurlin, M., B., Cross, B., Barker, C., Divine. 2019. Nuclear magnetic resonance logging: Example applications of an emerging tool for environmental investigations. Remediation, 29:63-73.

Suthersan, S.S., C. Divine, J. Quinnan, and E. Nichols. 2010. Flux-informed remediation decision making. Groundwater Monitoring & Remediation, 30(1): 45-50.

Taylor, J.R. 1997. An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, 2nd Ed. University Science Books, Sausalito, CA.

Trost, J.J., T.M. Christy, and B.A. Bekins. 2018. A Direct-Push Freezing Core Barrel for Sampling Unconsolidated Subsurface Sediments and Adjacent Pore Fluids. Vadose Zone Journal 17, 1–10. https://doi.org/10.2136/vzj2018.02.0037.

# APPENDIX A POINTS OF CONTACT

| Point of Contact Name | Organization Name Address | Phone Email | Role in Project |
|---|---|---|---|
| Craig Divine | Arcadis | 720-308-5367, craig.divine@acadis.com | Principal Investigator |
| Lance Robinson | En Rx | 352-514-9844, robinson@enrxinc.com | VWS system design and technology owner |

# APPENDIX B HYDRAULIC PROFILING TOOL FINAL DATA REPORT

CASCADE
DRILLING | TECHNICAL SERVICES

09/16/2021

# FINAL DATA REPORT

## High Resolution Site Characterization

## Hydraulic Profiling Tool (HPT)

Camp Grayling Site
Grayling, Michigan
207211037

**Prepared for:**
Arcadis
Kristen Hasbrouck
630 Plaza Drive Suite 600
Highlands Ranch, CO 80129

# TABLE OF CONTENTS


Program Narrative 1

QA/QC Summary Table 2

Project Details 3

- Cascade Personnel 3
- Cascade Equipment 3

Interpretation and Recommendations 4

- Data Interpretation 4
- Recommendations 4

Reference Material 5

- HPT System Overview 5
- HPT Data Interpretation 6
- EC Data Interpretation 7

Site Plan

Investigation Data Plots

Investigation Data Plots – Common Scale

# PROGRAM NARRATIVE

Cascade Technical Services (Cascade) is pleased to present this data report to Arcadis for the Hydraulic Profiling Tool (HPT) services provided between September 9th, 2021 at the Grayling Army Airfield in Grayling, Michigan.

Cascade advanced six HPT borings at the site achieving depths up to approximately 40 feet below ground surface. For each location, Cascade generated a continuous log of the electrical conductivity (EC) and HPT data from ground surface to termination.

Field work, including the operation of the HPT and EC probe, was conducted by trained professionals and quality assurance/quality control (QA/QC) measurements associated with these data were found to be within the tolerances set forth in the standard operating procedures (SOPs) with no exceptions.

Additional information regarding the HPT and EC systems is provided in the reference material included in this report.

I certify that the data package is in compliance with the terms and conditions of the contract and meets Cascade's data quality standards, with no exceptions. Release of the data contained in this package has been authorized by the data manager or his/her designee, as verified by the following signature.



Brad Carlson
Regional Manager, Site Characterization

# QA/QC SUMMARY TABLE

Provided below is a summary of QA/QC information and any deviations from the SOPs that occurred during the field activities.

| Location | Date | Time | Total Depth (ft bgs) | Response Test | Comments / Deviations |
|---|---|---|---|---|---|
| HPT-VRTB-01 | September 9, 2021 | 15:04:27 | 40.2 | Pass | None |
| HPT-VRTB-02 | September 9, 2021 | 16:03:49 | 40.05 | Pass | None |
| HPT-VRTB-03 | September 9, 2021 | 12:40:21 | 40 | Pass | None |
| HPT-VRTB-04 | September 9, 2021 | 17:00:16 | 40.15 | Pass | None |
| HPT-VRTB-05 | September 9, 2021 | 17:46:02 | 40.25 | Pass | None |
| HPT-VRTB-06 | September 9, 2021 | 13:58:28 | 40.2 | Pass | None |

# PROJECT DETAILS

This section provides information regarding the Cascade personnel present at the site during the field activities and the specific equipment used during field activities.

## Cascade Personnel

The following personnel were present during field activities at the Site:

- Rich Regan, HRSC Specialist
- Todd Grossmann Jr., DPT Rig Operator

## Cascade Equipment

The following HRSC equipment was utilized during field activities at the Site:

- Geoprobe 78 Series direct push drill rig
- 1.75-inch O.D. MH6534 HPT probe
- Geoprobe K6300 HPT Controller
- Geoprobe FI 6000 Computer
- 150-foot HPT trunkline
- 1.75-inch O.D. drive rods

# INTERPRETATION AND RECOMMENDATIONS

This section provides a summary of the data collected during this investigation program, Cascade's recommendations for updating the conceptual site model, and suggestions for next steps in the site management process, including remediation, if appropriate.

## Data Interpretation

A detailed, written interpretation of the data collected during this field event was not included in the contracted scope of work, however, Cascade was in contact with the project team throughout the field mobilization and submitted daily HRSC logs.

## Recommendations

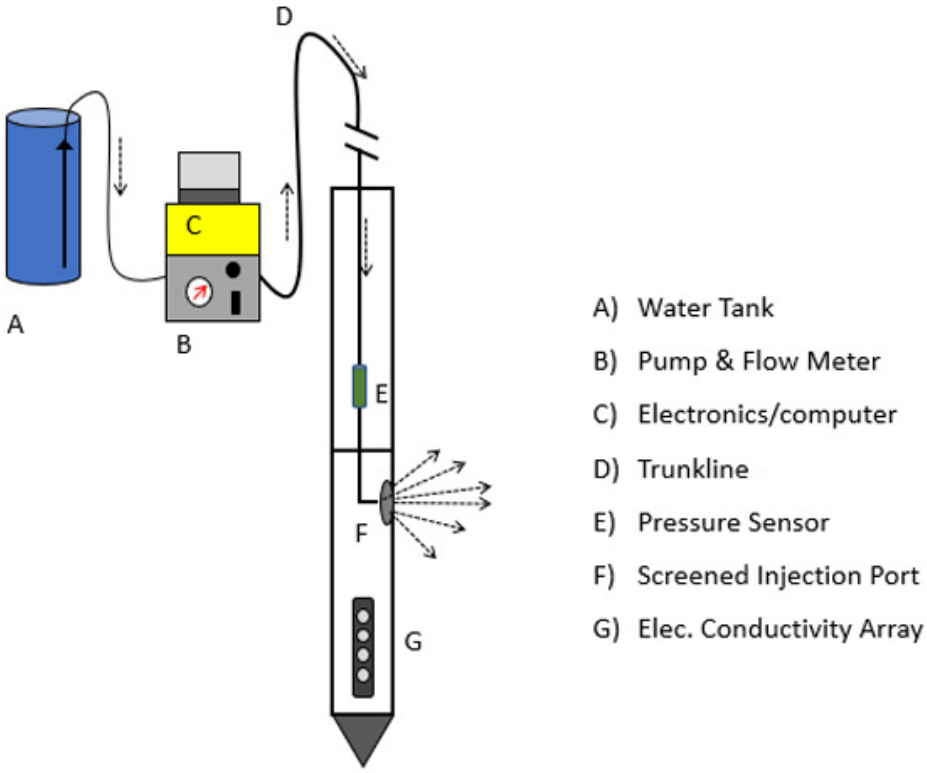
Additional recommendations were not included in this scope of work. Please contact the Cascade Project Manager if you would like to discuss further investigation or remediation alternatives. We would be excited to continue to learn about this site and assist you in meeting your site management goals.

# REFERENCE MATERIAL

This section provides information useful in understanding and interpreting the data logs generated as part of this HRSC investigation.

## HPT System Overview

The hydraulic profiling tool creates a log of the relative formation permeability versus depth in real time as the probe is advanced into the subsurface. It operates by injecting clean water at a constant flow rate from an aboveground reservoir through the direct push rods and out into the surrounding soil via an injection port on the side of the probe. Simultaneously, sensors record the flow rate, the back pressure required by the pump to maintain that flow rate, and the current depth of the probe. These measurements are collected by the onboard software and an estimated hydraulic conductivity (K) value is calculated and plotted alongside the other measurements in real time.




Generalized schematic of the HPT tool. Source: Geoprobe HPT Standard Operating Procedure

### Reference Testing and Dissipation Tests

Reference testing is conducted to ensure that the HPT pressure transducer is working correctly and to evaluate the condition of the HPT injection screen. The HPT reference test also calculates atmospheric pressure which is required to obtain static water level readings and to determine the estimated K values for the log. The reference test utilizes an apparatus consisting of a tube with a valve located 6 inches above the HPT injection screen and the top of the tube located another 6 inches above the valve. When the tube is filled completely with water, the 12 inches of water will supply an additional 0.433 pounds per square inch (psi) of pressure on the injection screen (in addition to atmospheric pressure). When the valve is opened that additional pressure drops to 0.217 psi at the HPT injection screen. The accuracy of the pressure transducer can be assessed by comparing the pressure readings when the tube is filled and when the tube is filled only to the valve; this is done both with and without the pump running. A tolerance of plus or minus 10 percent is applied for a passing test.

Dissipation tests are conducted to determine the hydrostatic pressure of the water column above the transducer during logging. To conduct a dissipation test, advancement of the tooling is stopped, the HPT pump is stopped, and flow drops to zero. The pressure applied to the HPT pressure transducer by the injection of water into the formation begins to dissipate. This pressure should dissipate to a value equal to atmospheric pressure plus the hydrostatic pressure applied by water in the formation. In post-processing of the HPT log, the dissipation value and the atmospheric pressure determined during reference testing can be used to remove the influence of atmospheric and hydrostatic pressures from the values recorded by the transducer. These adjustments result in the corrected HPT pressure log which is a measure of the properties of the subsurface material.

## HPT Data Interpretation

An HPT log typically includes several types of data, many of which are reduced by the software to generate the estimated K values. The dissipation testing results conducted by the operator during the advancement of the tool are used to adjust the HPT back pressure values to account for the hydrostatic pressure of the water column above the probe during advancement. This adjustment results in the corrected HPT pressure data set. Subsequently, the corrected HPT pressure and the HPT flow data sets are used to calculate the estimated K values.

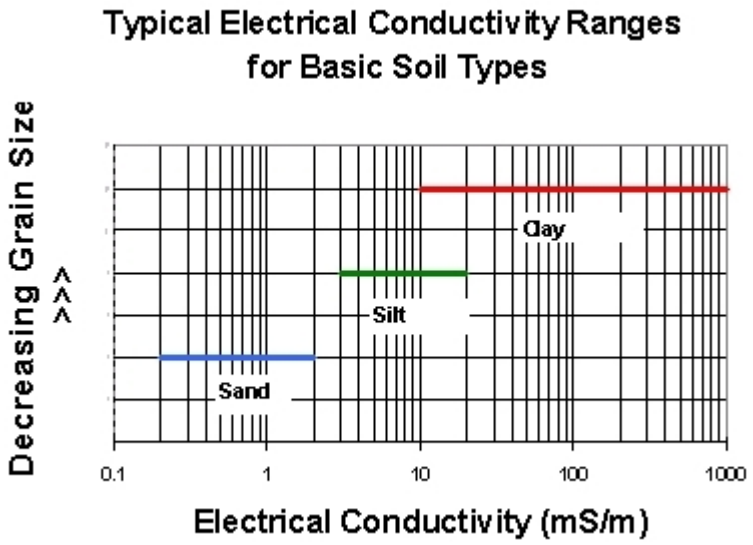
The most useful measurement from the HPT is the estimated K log, which as noted above, is a measure of the relative permeability of the formation versus depth. Despite the fact that these data are presented in units typical of traditional hydraulic conductivity (feet per day), they are not traditional K values and should not be used in many of the applications where a traditional K value would be appropriate. The accuracy of the estimated K values is typically one to two orders of magnitude, which would clearly generate a significant amount of uncertainty if used for any seepage velocity or risk-based calculations. The estimated K values are, however, extremely useful for understanding what zones of the subsurface are exhibiting higher or lower relative permeability.

As a secondary data set from this tool, the HPT back pressure can be helpful in the design of injected remedies. The back pressure is a measure of the level of difficulty faced injecting the

clean water from the HPT system into the formation; this is analogous to level of success an injection may achieve at the same depths.

## EC Data Interpretation

In a general sense, the electrical conductivity of a soil varies with grain size. This correlation can be utilized to gather an understanding of the subsurface from the EC data. The EC measured in the subsurface can also vary based on changes in mineralogy, groundwater geochemistry, and contamination. It is important, then, to confirm the accuracy of the EC data for this use by collecting confirmatory soil borings from your site.

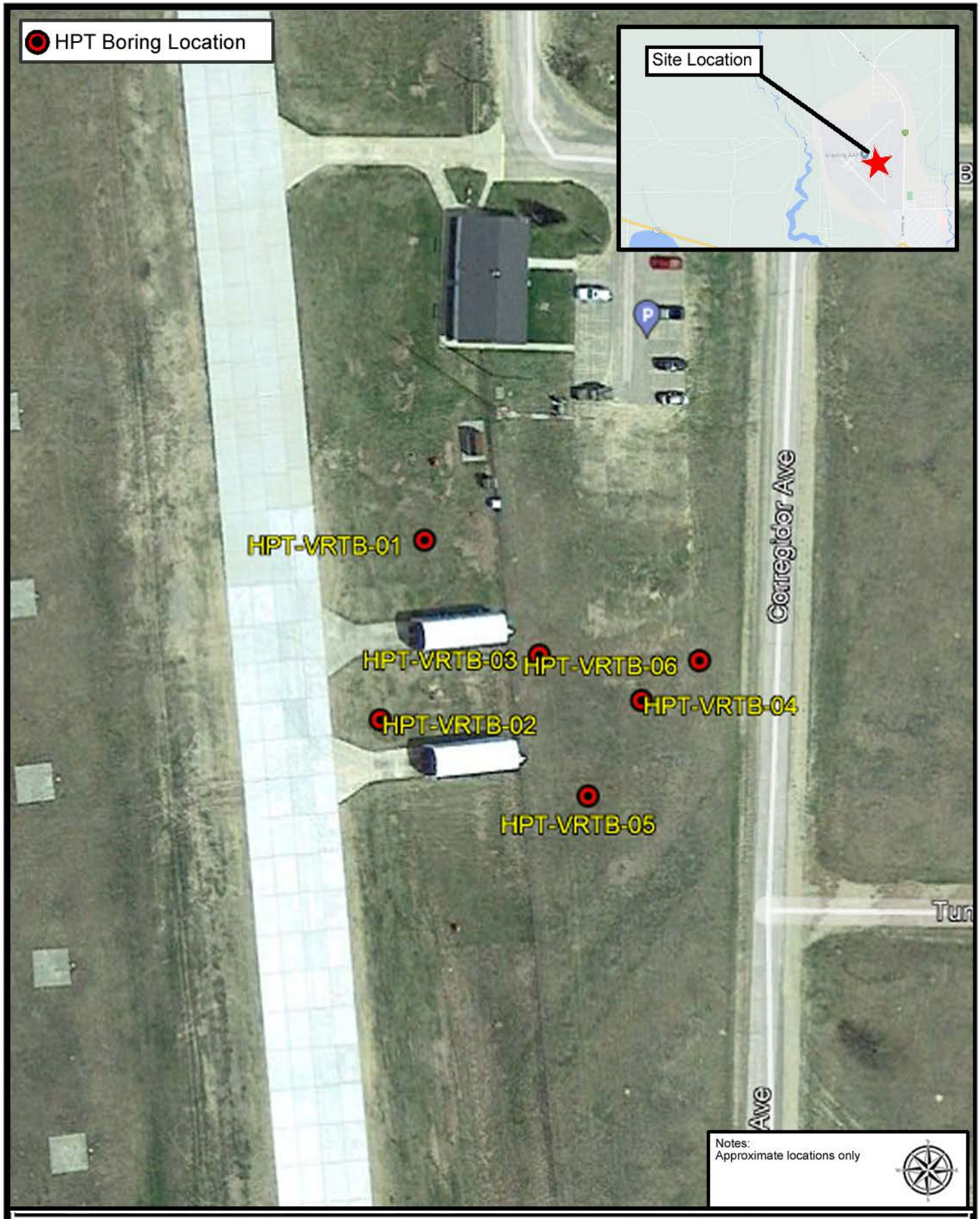



Relationship between electrical conductivity and grain size. Source: Geoprobe Electrical Conductivity System Standard Operating Procedure

CASCADE

DRILLING | TECHNICAL SERVICES

# SITE PLAN




CASCADE
DRILLING | TECHNICAL SERVICES

# Grayling Army Airfield
# Grayling, Michigan

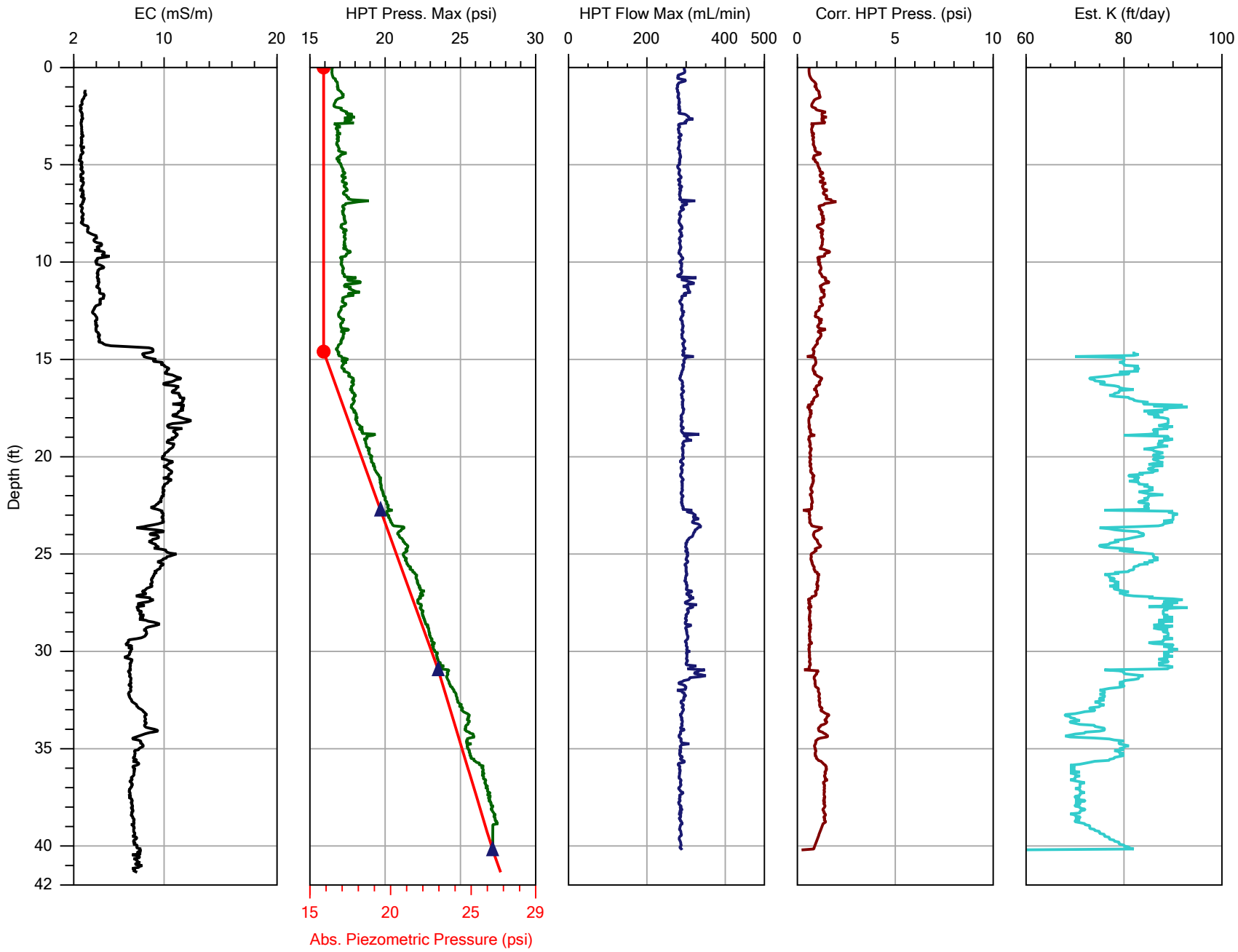
Arcadis
HPT
Investigtion Locations

| Prepared by: WBC | Date:9/16/2021 | Project No. 207211037 | Figure 1 |
|---|---|---|---|

CASCADE

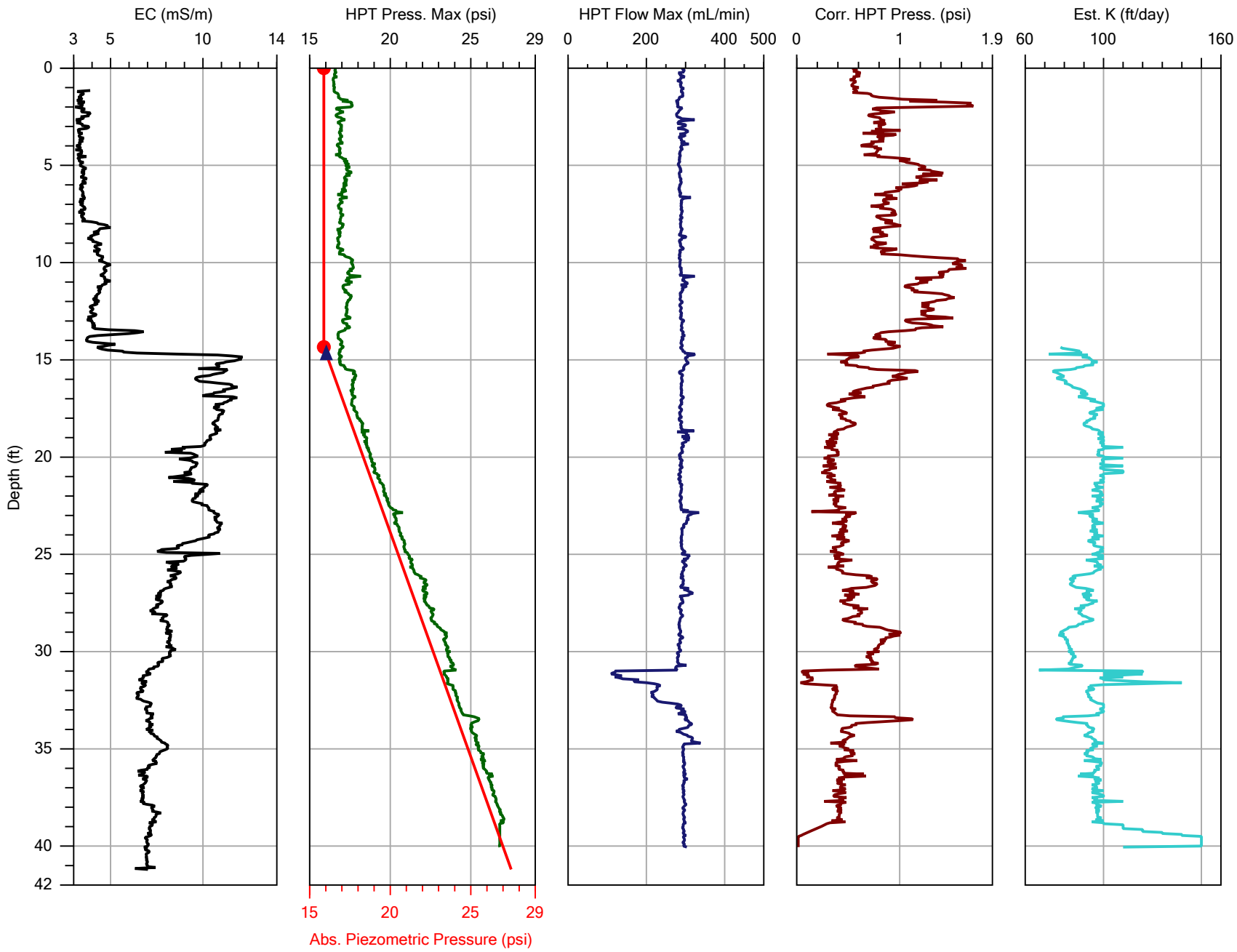
DRILLING | TECHNICAL SERVICES

# INVESTIGATION DATA PLOTS



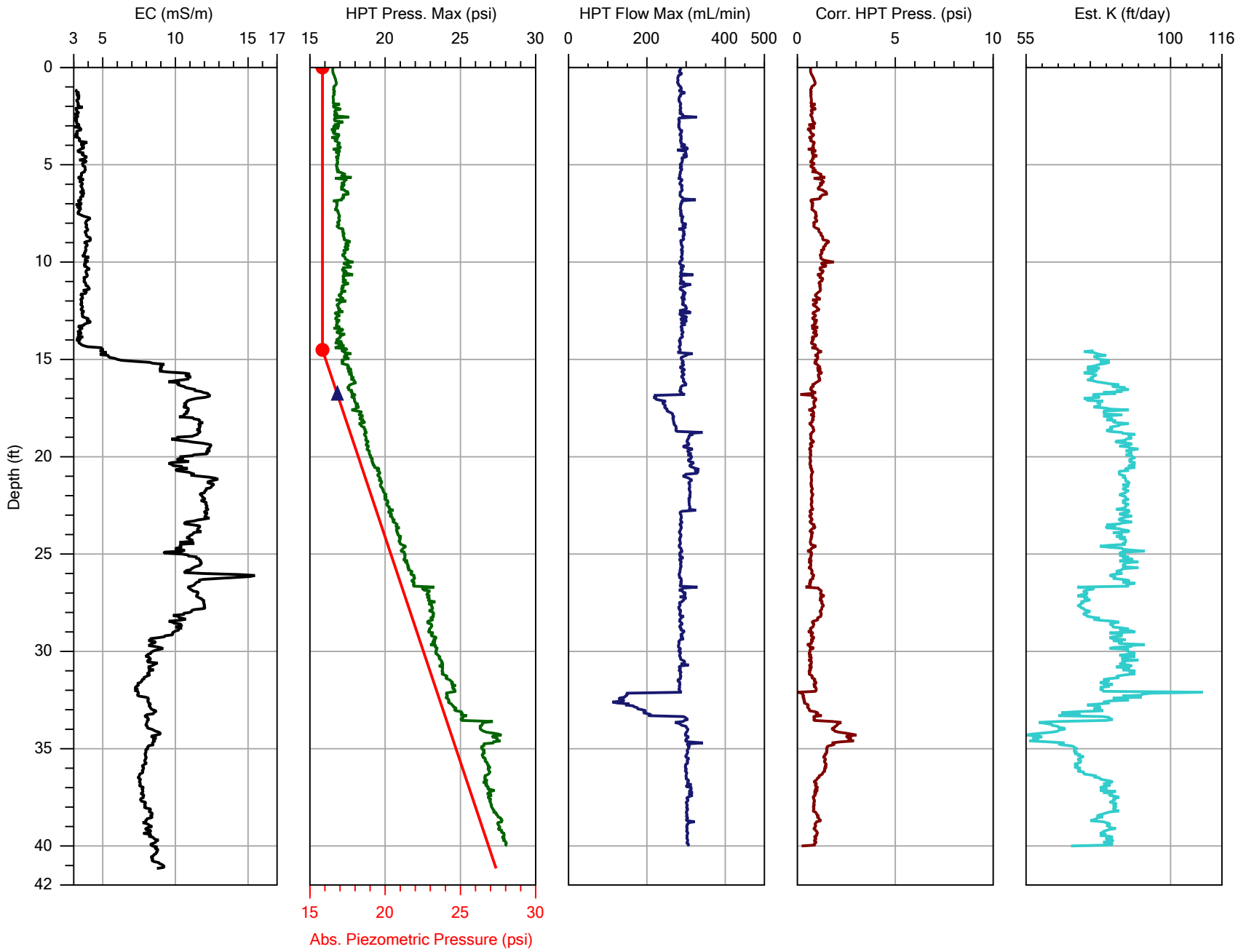

CASCADE
DRILLING | TECHNICAL SERVICES

| | | |
|---|---|---|
| | | File: HPT-VRTB-01.HPT |
| Company: Cascade | Operator: Rich Reagan | Date: 09/09/21 |
| Project ID: 207211037 | Client: Arcadis | Location: Grayling Mi |



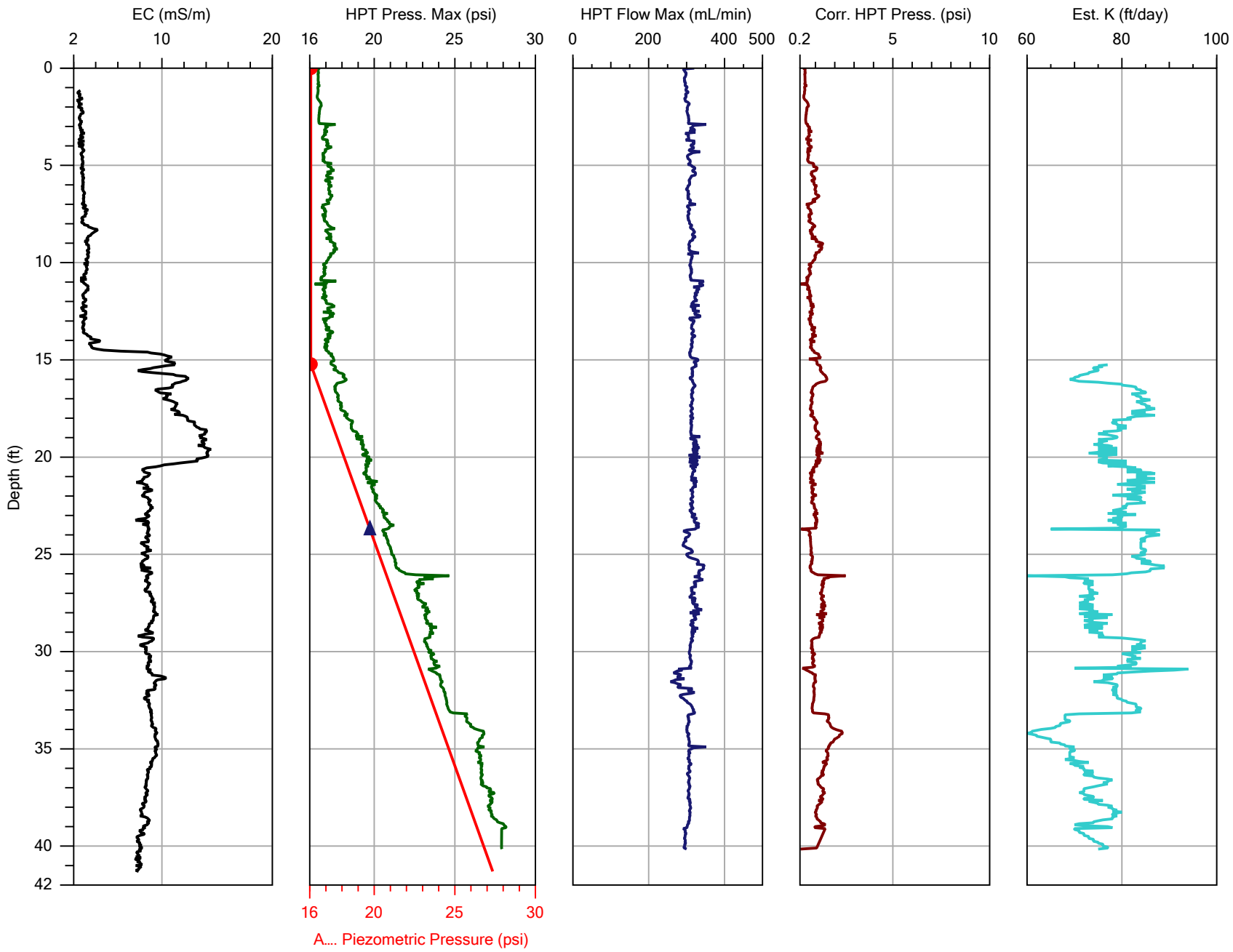

CASCADE
DRILLING | TECHNICAL SERVICES

| | | | |
|---|---|---|---|
| Company: Cascade | Operator: Rich Reagan | | File: HPT-VRTB-02.HPT |
| Project ID: 207211037 | Client: Arcadis | | Date: 09/09/21 |
| | | | Location: Grayling Mi |



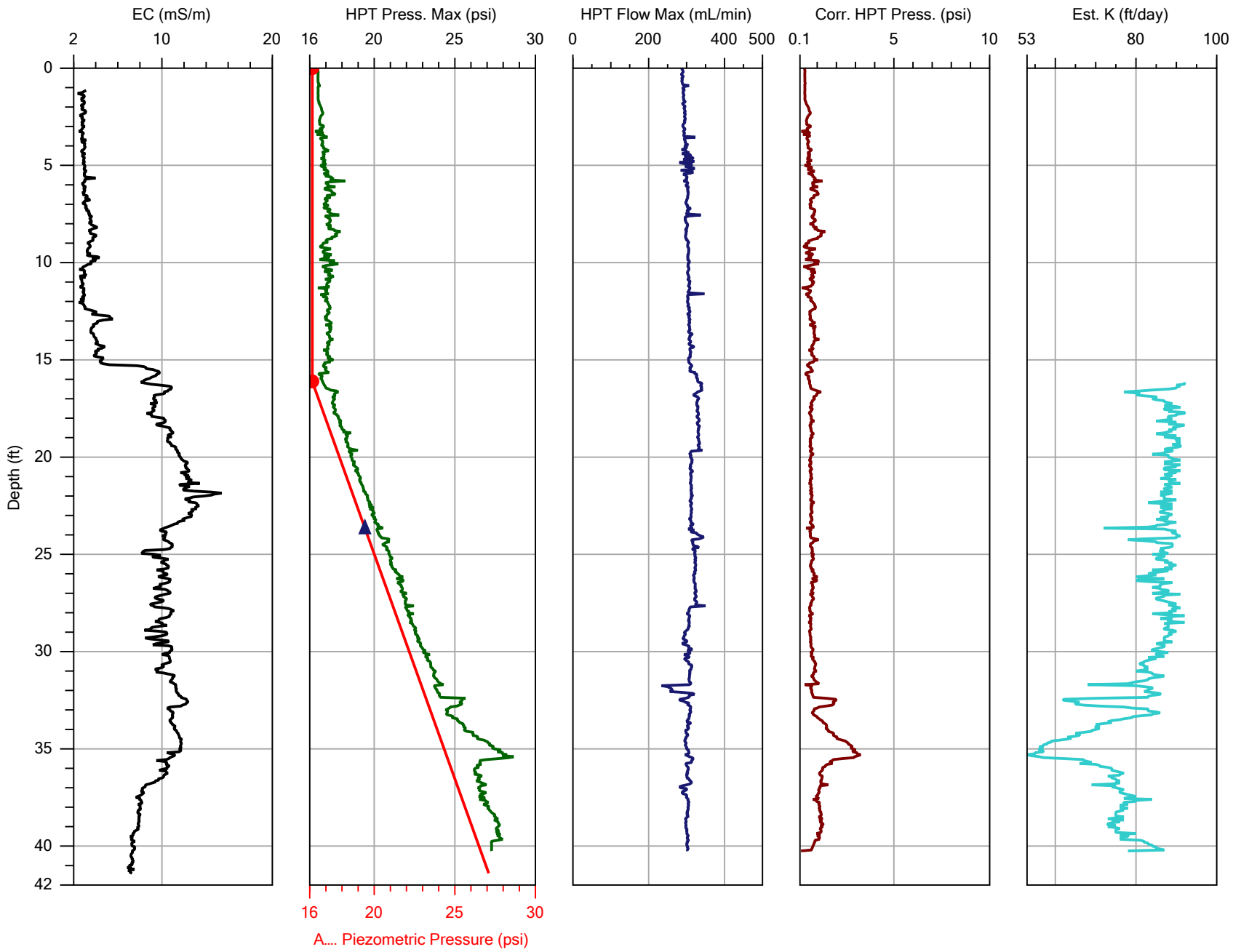

CASCADE
DRILLING | TECHNICAL SERVICES

| | | |
|---|---|---|
| | | File: HPT-VRTB-03.HPT |
| Company: Cascade | Operator: Rich Reagan | Date: 09/09/21 |
| Project ID: 207211037 | Client: Arcadis | Location: Grayling Mi |



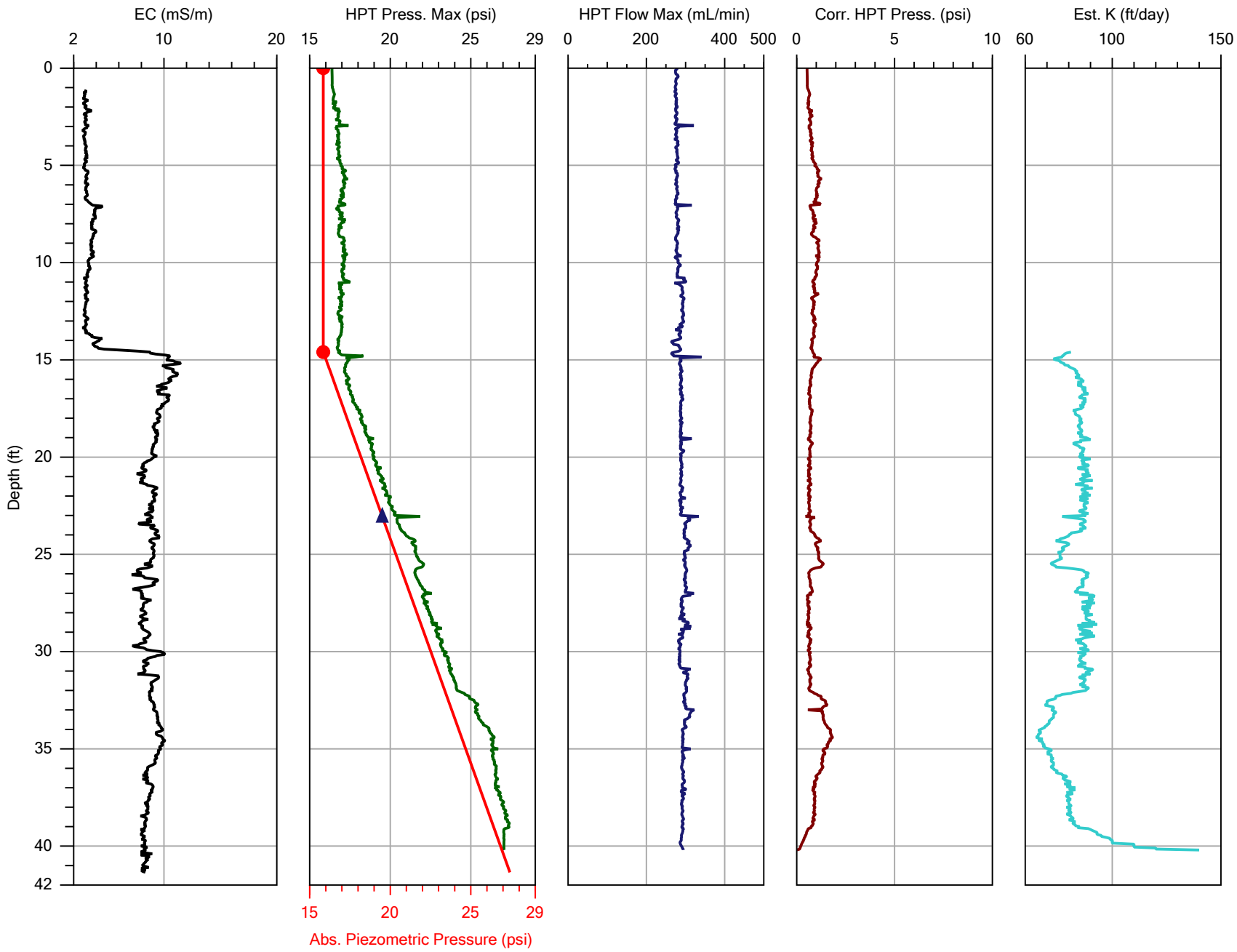

CASCADE
DRILLING | TECHNICAL SERVICES

| | | |
|---|---|---|
| | | File: HPT-VRTB-04.HPT |
| Company: Cascade | Operator: Rich Reagan | Date: 09/09/21 |
| Project ID: 207211037 | Client: Arcadis | Location: Grayling Mi |




CASCADE
DRILLING | TECHNICAL SERVICES

| | | |
|---|---|---|
| | | File: HPT-VRTB-05.HPT |
| Company: Cascade | Operator: Rich Reagan | Date: 09/09/21 |
| Project ID: 207211037 | Client: Arcadis | Location: Grayling Mi |




CASCADE
DRILLING | TECHNICAL SERVICES

| | | |
|---|---|---|
| | | File: HPT-VRTB-06.HPT |
| Company: Cascade | Operator: Rich Reagan | Date: 09/09/21 |
| Project ID: 207211037 | Client: Arcadis | Location: Grayling Mi |

# APPENDIX C LABORATORY ANALYTICAL REPORTS

# Appendix C-1 VAP Groundwater Samples

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP Vertebrae

Project Number: 30027244

Lot Number:**WI18005**

Date Completed:10/22/2021

10/22/2021 3:31 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: WI18005

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

Samples WI18005-001, WI18005-002 required centrifugation prior to extraction, due to excessive solids present in the samples. Centrifugation was performed following the PFAS Aqueous Centrifuge Protocol; samples were spiked with Surrogate (SUR; Extracted Internal Standard/EIS) and shaken vigorously before being poured into a conical bottle and centrifuged. The centrifuged aqueous sample was decanted back into the original sample bottle, off of the condensed solids remaining in the centrifuge bottle. Original sample bottle was rinsed as normal and centrifuge bottle was rinsed with 4mL of MeOH. Centrifuge bottle rinsate was added to the elution. Samples concentrated to <10mL and reconstituted to 10mL using MeOH by transfer pipet.

Surrogate recovery for the following samples were outside control limits: WI18005-008, WI18005-009. Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Surrogate recovery for the following samples was outside the upper control limit: WI18005-001, WI18005-002, WI18005-005, WI18005-010. This sample did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

The MS/MSD associated with sample WI18005-004 had multiple analytes recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

The laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for prep batch 18205 exceeded acceptance criteria for the 6:2-FTS EIS compound. 6-FTS was not detected in the samples affected: WI18005-001, WI18005-002.

The method blank for prep batch 18279 contained analyte 6:2 FTS was greater than the acceptance criteria. The associated samples, WI18005-004, WI18005-005, WI18005-008, WI18005-009 did not contain detections and/or less than 1/2 of LOQ for the target analyte; therefore, re-extraction and/or re-analysis of samples was not performed. The data has been reported.

The method blank for prep batch 18955 contained analyte: 6:2 FTS greater than the acceptance criteria. The associated sample, WI18005-006, WI18005-007 was re-prepped and re-analyzed outside of holding time. Both sets of data has been reported.

## Sample Summary

## Arcadis U.S., Inc.

**Lot Number: WI18005**

**Project Name: ESTCP Vertebrae**

**Project Number: 30027244**

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | VAP-VRTB-04_36-40 | Aqueous | 09/13/2021 1200 | 09/18/2021 |
| 002 | VAP-VRTB-04_29-33 | Aqueous | 09/13/2021 1530 | 09/18/2021 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | 09/13/2021 1630 | 09/18/2021 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | 09/13/2021 1710 | 09/18/2021 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | 09/13/2021 1805 | 09/18/2021 |
| 006 | VAP-VRTB-02_30-34 | Aqueous | 09/14/2021 1105 | 09/18/2021 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | 09/14/2021 1310 | 09/18/2021 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | 09/14/2021 1415 | 09/18/2021 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | 09/14/2021 1535 | 09/18/2021 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | 09/14/2021 | 09/18/2021 |

(10 samples)

## Detection Summary

## Arcadis U.S., Inc.

**Lot Number: WI18005**

**Project Name: ESTCP Vertebrae**

**Project Number: 30027244**

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | VAP-VRTB-04_36-40 | Aqueous | PFBS | PFAS by ID | 10 | | ng/L | 9 |
| 001 | VAP-VRTB-04_36-40 | Aqueous | PFHpS | PFAS by ID | 3.9 | | ng/L | 9 |
| 001 | VAP-VRTB-04_36-40 | Aqueous | PFPeS | PFAS by ID | 15 | | ng/L | 9 |
| 001 | VAP-VRTB-04_36-40 | Aqueous | PFHxS | PFAS by ID | 160 | | ng/L | 9 |
| 001 | VAP-VRTB-04_36-40 | Aqueous | PFBA | PFAS by ID | 5.8 | | ng/L | 9 |
| 001 | VAP-VRTB-04_36-40 | Aqueous | PFHpA | PFAS by ID | 7.7 | | ng/L | 9 |
| 001 | VAP-VRTB-04_36-40 | Aqueous | PFHxA | PFAS by ID | 15 | | ng/L | 9 |
| 001 | VAP-VRTB-04_36-40 | Aqueous | PFOA | PFAS by ID | 21 | | ng/L | 9 |
| 001 | VAP-VRTB-04_36-40 | Aqueous | PFPeA | PFAS by ID | 9.2 | | ng/L | 9 |
| 001 | VAP-VRTB-04_36-40 | Aqueous | PFOS | PFAS by ID | 140 | | ng/L | 9 |
| 002 | VAP-VRTB-04_29-33 | Aqueous | PFBS | PFAS by ID | 7.4 | | ng/L | 11 |
| 002 | VAP-VRTB-04_29-33 | Aqueous | PFHpS | PFAS by ID | 2.4 | J | ng/L | 11 |
| 002 | VAP-VRTB-04_29-33 | Aqueous | PFPeS | PFAS by ID | 12 | | ng/L | 11 |
| 002 | VAP-VRTB-04_29-33 | Aqueous | PFHxS | PFAS by ID | 130 | | ng/L | 11 |
| 002 | VAP-VRTB-04_29-33 | Aqueous | PFBA | PFAS by ID | 4.9 | | ng/L | 11 |
| 002 | VAP-VRTB-04_29-33 | Aqueous | PFHpA | PFAS by ID | 5.9 | | ng/L | 11 |
| 002 | VAP-VRTB-04_29-33 | Aqueous | PFHxA | PFAS by ID | 9.6 | | ng/L | 11 |
| 002 | VAP-VRTB-04_29-33 | Aqueous | PFOA | PFAS by ID | 16 | | ng/L | 11 |
| 002 | VAP-VRTB-04_29-33 | Aqueous | PFPeA | PFAS by ID | 6.6 | | ng/L | 11 |
| 002 | VAP-VRTB-04_29-33 | Aqueous | PFOS | PFAS by ID | 110 | | ng/L | 11 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFBS | PFAS by ID | 3.5 | | ng/L | 13 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFHpS | PFAS by ID | 16 | | ng/L | 13 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFOSA | PFAS by ID | 0.95 | J | ng/L | 13 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFPeS | PFAS by ID | 7.4 | | ng/L | 13 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFHxS | PFAS by ID | 150 | | ng/L | 13 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFBA | PFAS by ID | 4.4 | | ng/L | 13 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFHpA | PFAS by ID | 5.0 | | ng/L | 13 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFHxA | PFAS by ID | 7.3 | | ng/L | 13 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFNA | PFAS by ID | 3.7 | | ng/L | 13 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFOA | PFAS by ID | 15 | | ng/L | 13 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFPeA | PFAS by ID | 4.8 | | ng/L | 13 |
| 003 | VAP-VRTB-04_23.5-27.5 | Aqueous | PFOS | PFAS by ID | 990 | | ng/L | 13 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | 8:2 FTS | PFAS by ID | 1.9 | J | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | 6:2 FTS | PFAS by ID | 2.2 | BJ | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFBS | PFAS by ID | 11 | | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFHpS | PFAS by ID | 78 | S | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFOSA | PFAS by ID | 1.3 | J | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFPeS | PFAS by ID | 32 | | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFHxS | PFAS by ID | 760 | | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFBA | PFAS by ID | 9.2 | | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFHpA | PFAS by ID | 14 | | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFHxA | PFAS by ID | 25 | | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFNA | PFAS by ID | 8.4 | | ng/L | 15 |

# Detection Summary (Continued)

## Lot Number: WI18005

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFOA | PFAS by ID | 55 | S | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFPeA | PFAS by ID | 12 | | ng/L | 15 |
| 004 | VAP-VRTB-04_19.5-23.5 | Aqueous | PFOS | PFAS by ID | 2500 | | ng/L | 15 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | PFBS | PFAS by ID | 3.6 | | ng/L | 17 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | PFHpS | PFAS by ID | 9.5 | | ng/L | 17 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | PFPeS | PFAS by ID | 2.7 | J | ng/L | 17 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | PFHxS | PFAS by ID | 67 | | ng/L | 17 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | PFBA | PFAS by ID | 6.3 | | ng/L | 17 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | PFHpA | PFAS by ID | 11 | | ng/L | 17 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | PFHxA | PFAS by ID | 10 | | ng/L | 17 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | PFNA | PFAS by ID | 2.4 | J | ng/L | 17 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | PFOA | PFAS by ID | 20 | | ng/L | 17 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | PFPeA | PFAS by ID | 7.6 | | ng/L | 17 |
| 005 | VAP-VRTB-04_15.5-19.5 | Aqueous | PFOS | PFAS by ID | 230 | | ng/L | 17 |
| 006 | VAP-VRTB-02_30-34 | Aqueous | PFPeS | PFAS by ID | 1.0 | J | ng/L | 19 |
| 006 | VAP-VRTB-02_30-34 | Aqueous | PFHxS | PFAS by ID | 24 | | ng/L | 19 |
| 006 | VAP-VRTB-02_30-34 | Aqueous | PFBA | PFAS by ID | 2.1 | J | ng/L | 19 |
| 006 | VAP-VRTB-02_30-34 | Aqueous | PFHpA | PFAS by ID | 1.3 | J | ng/L | 19 |
| 006 | VAP-VRTB-02_30-34 | Aqueous | PFHxA | PFAS by ID | 2.3 | J | ng/L | 19 |
| 006 | VAP-VRTB-02_30-34 | Aqueous | PFNA | PFAS by ID | 0.88 | J | ng/L | 19 |
| 006 | VAP-VRTB-02_30-34 | Aqueous | PFOA | PFAS by ID | 1.9 | J | ng/L | 19 |
| 006 | VAP-VRTB-02_30-34 | Aqueous | PFPeA | PFAS by ID | 1.6 | J | ng/L | 19 |
| 006 | VAP-VRTB-02_30-34 | Aqueous | PFOS | PFAS by ID | 78 | | ng/L | 19 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | PFBS | PFAS by ID | 1.3 | J | ng/L | 23 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | PFHpS | PFAS by ID | 1.1 | J | ng/L | 23 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | PFPeS | PFAS by ID | 1.0 | J | ng/L | 23 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | PFHxS | PFAS by ID | 31 | | ng/L | 23 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | PFBA | PFAS by ID | 3.6 | | ng/L | 23 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | PFHpA | PFAS by ID | 3.6 | | ng/L | 23 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | PFHxA | PFAS by ID | 2.8 | J | ng/L | 23 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | PFNA | PFAS by ID | 1.2 | J | ng/L | 23 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | PFOA | PFAS by ID | 4.2 | | ng/L | 23 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | PFPeA | PFAS by ID | 2.4 | J | ng/L | 23 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | PFOS | PFAS by ID | 92 | | ng/L | 23 |
| 007 | VAP-VRTB-02_25-29 | Aqueous | 6:2 FTS | PFAS by ID | 2.7 | BHJ | ng/L | 25 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | PFBS | PFAS by ID | 1.6 | J | ng/L | 27 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | PFHpS | PFAS by ID | 2.6 | J | ng/L | 27 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | PFPeS | PFAS by ID | 2.0 | J | ng/L | 27 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | PFHxS | PFAS by ID | 59 | | ng/L | 27 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | PFBA | PFAS by ID | 6.8 | | ng/L | 27 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | PFHpA | PFAS by ID | 7.4 | | ng/L | 27 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | PFHxA | PFAS by ID | 7.6 | | ng/L | 27 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | PFNA | PFAS by ID | 1.2 | J | ng/L | 27 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | PFOA | PFAS by ID | 10 | | ng/L | 27 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | PFPeA | PFAS by ID | 6.3 | | ng/L | 27 |
| 008 | VAP-VRTB-02_20-24 | Aqueous | PFOS | PFAS by ID | 85 | | ng/L | 27 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | 8:2 FTS | PFAS by ID | 3.8 | JQ | ng/L | 29 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | 6:2 FTS | PFAS by ID | 2.5 | BJ | ng/L | 29 |

# Detection Summary (Continued)

## Lot Number: WI18005

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 009 | VAP-VRTB-02_15-19 | Aqueous | PFBS | PFAS by ID | 2.3 | J | ng/L | 29 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | PFHpS | PFAS by ID | 3.3 | J | ng/L | 29 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | PFPeS | PFAS by ID | 1.9 | J | ng/L | 29 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | PFHxS | PFAS by ID | 72 | | ng/L | 29 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | PFBA | PFAS by ID | 7.5 | | ng/L | 29 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | PFHpA | PFAS by ID | 12 | | ng/L | 29 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | PFHxA | PFAS by ID | 10 | | ng/L | 29 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | PFNA | PFAS by ID | 2.5 | J | ng/L | 29 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | PFOA | PFAS by ID | 9.4 | | ng/L | 29 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | PFPeA | PFAS by ID | 9.2 | | ng/L | 29 |
| 009 | VAP-VRTB-02_15-19 | Aqueous | PFOS | PFAS by ID | 650 | | ng/L | 29 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | 8:2 FTS | PFAS by ID | 2.9 | J | ng/L | 31 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | PFBS | PFAS by ID | 1.7 | J | ng/L | 31 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | PFHpS | PFAS by ID | 2.3 | J | ng/L | 31 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | PFPeS | PFAS by ID | 1.6 | J | ng/L | 31 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | PFHxS | PFAS by ID | 54 | | ng/L | 31 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | PFBA | PFAS by ID | 5.3 | | ng/L | 31 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | PFHpA | PFAS by ID | 8.8 | | ng/L | 31 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | PFHxA | PFAS by ID | 7.5 | | ng/L | 31 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | PFNA | PFAS by ID | 2.2 | J | ng/L | 31 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | PFOA | PFAS by ID | 6.7 | | ng/L | 31 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | PFPeA | PFAS by ID | 6.8 | | ng/L | 31 |
| 010 | VAP-VRTB-DUP-02 | Aqueous | PFOS | PFAS by ID | 500 | | ng/L | 31 |

(114 detections)

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-001**

Description: **VAP-VRTB-04_36-40** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1200** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2102 | JJG | 10/08/2021 1611 | 18205 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **10** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **3.9** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **15** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **160** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **5.8** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **7.7** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **15** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **21** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **9.2** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **140** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 136 | 50-150 |
| 13C2_6:2FTS | N | 169 | 50-150 |
| 13C2_8:2FTS | N | 181 | 50-150 |
| 13C2_PFDoA | | 76 | 50-150 |
| 13C2_PFTeDA | | 61 | 50-150 |
| 13C3_PFBS | | 89 | 50-150 |
| 13C3_PFHxS | | 83 | 50-150 |
| 13C4_PFBA | | 94 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 |
| 13C5_PFHxA | | 88 | 50-150 |
| 13C5_PFPeA | | 95 | 50-150 |
| 13C6_PFDA | | 104 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |
| 13C8_PFOS | | 84 | 50-150 |
| 13C8_PFOSA | | 84 | 50-150 |
| 13C9_PFNA | | 84 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-001**

Description: **VAP-VRTB-04_36-40** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1200** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 65 | 50-150 |
| d3-MeFOSAA | | 117 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-002**

Description: **VAP-VRTB-04_29-33** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1530** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2113 | JJG | 10/08/2021 1611 | 18205 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **7.4** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **2.4** | **J** | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **12** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **130** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **4.9** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **5.9** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **9.6** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **16** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **6.6** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **110** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 95 | 50-150 |
| 13C2_6:2FTS | N | 166 | 50-150 |
| 13C2_8:2FTS | | 87 | 50-150 |
| 13C2_PFDoA | | 65 | 50-150 |
| 13C2_PFTeDA | | 65 | 50-150 |
| 13C3_PFBS | | 81 | 50-150 |
| 13C3_PFHxS | | 74 | 50-150 |
| 13C4_PFBA | | 84 | 50-150 |
| 13C4_PFHpA | | 79 | 50-150 |
| 13C5_PFHxA | | 83 | 50-150 |
| 13C5_PFPeA | | 84 | 50-150 |
| 13C6_PFDA | | 81 | 50-150 |
| 13C7_PFUdA | | 75 | 50-150 |
| 13C8_PFOA | | 85 | 50-150 |
| 13C8_PFOS | | 77 | 50-150 |
| 13C8_PFOSA | | 78 | 50-150 |
| 13C9_PFNA | | 80 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-002**

Description: **VAP-VRTB-04_29-33** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1530** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 76 | 50-150 |
| d-MeFOSA | | 68 | 50-150 |
| d3-MeFOSAA | | 86 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-003**

Description: **VAP-VRTB-04_23.5-27.5** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1630** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2021 1818 | NK1 | 10/10/2021 1333 | 18279 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/13/2021 1521 | MMM | 10/10/2021 1333 | 18279 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.4 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 6.5 | U | 13 | 6.5 | 3.3 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **3.5** | | **3.3** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.3 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **16** | | **3.3** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.3 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-1-octanesulfonamide (PFOSA)** | **754-91-6** | **PFAS by ID SOP** | **0.95** | **J** | **3.3** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **7.4** | | **3.3** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **150** | | **3.3** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **4.4** | | **3.3** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.3 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.3 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **5.0** | | **3.3** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **7.3** | | **3.3** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **3.7** | | **3.3** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **15** | | **3.3** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **4.8** | | **3.3** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.3 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.3 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.3 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **990** | | **17** | 8.5 | **4.2** | **ng/L** | **2** |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 122 | 50-150 | | 122 | 50-150 |
| 13C2_6:2FTS | | 102 | 50-150 | | 136 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 | | 110 | 50-150 |
| 13C2_PFDoA | | 101 | 50-150 | | 93 | 50-150 |
| 13C2_PFTeDA | | 89 | 50-150 | | 104 | 50-150 |
| 13C3_PFBS | | 104 | 50-150 | | 107 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 | | 104 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 | | 109 | 50-150 |
| 13C4_PFHpA | | 91 | 50-150 | | 112 | 50-150 |
| 13C5_PFHxA | | 86 | 50-150 | | 107 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 | | 108 | 50-150 |
| 13C6_PFDA | | 97 | 50-150 | | 100 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 | | 103 | 50-150 |
| 13C8_PFOA | | 96 | 50-150 | | 110 | 50-150 |
| 13C8_PFOS | | 91 | 50-150 | | 97 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 | | 97 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-003**

Description: **VAP-VRTB-04_23.5-27.5** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1630** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 90 | 50-150 | | 98 | 50-150 |
| d5-EtFOSAA | | 95 | 50-150 | | 102 | 50-150 |
| d-MeFOSA | | 90 | 50-150 | | 92 | 50-150 |
| d3-MeFOSAA | | 107 | 50-150 | | 111 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-004**

Description: **VAP-VRTB-04_19.5-23.5** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1710** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2021 1839 | NK1 | 10/10/2021 1333 | 18279 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/13/2021 1532 | MMM | 10/10/2021 1333 | 18279 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| **1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)** | **39108-34-4** | **PFAS by ID SOP** | **1.9** | **J** | **6.8** | 3.4 | **1.7** | **ng/L** | **1** |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **2.2** | **BJ** | **6.8** | 3.4 | **1.7** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **11** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **78** | **S** | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-1-octanesulfonamide (PFOSA)** | **754-91-6** | **PFAS by ID SOP** | **1.3** | **J** | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **32** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **760** | | **17** | 8.5 | **4.3** | **ng/L** | **2** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **9.2** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **14** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **25** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **8.4** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **55** | **S** | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **12** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **2500** | | **17** | 8.5 | **4.3** | **ng/L** | **2** |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 116 | 50-150 | | 120 | 50-150 |
| 13C2_6:2FTS | | 103 | 50-150 | | 146 | 50-150 |
| 13C2_8:2FTS | | 94 | 50-150 | | 105 | 50-150 |
| 13C2_PFDoA | | 93 | 50-150 | | 96 | 50-150 |
| 13C2_PFTeDA | | 81 | 50-150 | | 98 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 | | 103 | 50-150 |
| 13C3_PFHxS | | 83 | 50-150 | | 107 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 | | 103 | 50-150 |
| 13C4_PFHpA | | 86 | 50-150 | | 117 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 | | 102 | 50-150 |
| 13C5_PFPeA | | 86 | 50-150 | | 101 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 | | 101 | 50-150 |
| 13C7_PFUdA | | 90 | 50-150 | | 105 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 | | 103 | 50-150 |
| 13C8_PFOS | | 81 | 50-150 | | 96 | 50-150 |
| 13C8_PFOSA | | 93 | 50-150 | | 90 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-004**

Description: **VAP-VRTB-04_19.5-23.5** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1710** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 80 | 50-150 | | 97 | 50-150 |
| d5-EtFOSAA | | 96 | 50-150 | | 100 | 50-150 |
| d-MeFOSA | | 89 | 50-150 | | 101 | 50-150 |
| d3-MeFOSAA | | 119 | 50-150 | | 93 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-005**

Description: **VAP-VRTB-04_15.5-19.5** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1805** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2021 1900 | NK1 | 10/10/2021 1333 | 18279 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **3.6** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **9.5** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **2.7** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **67** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **6.3** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **11** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **10** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **2.4** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **20** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **7.6** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **230** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | N | 151 | 50-150 |
| 13C2_6:2FTS | | 122 | 50-150 |
| 13C2_8:2FTS | | 109 | 50-150 |
| 13C2_PFDoA | | 103 | 50-150 |
| 13C2_PFTeDA | | 89 | 50-150 |
| 13C3_PFBS | | 105 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 |
| 13C4_PFBA | | 99 | 50-150 |
| 13C4_PFHpA | | 101 | 50-150 |
| 13C5_PFHxA | | 98 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 |
| 13C6_PFDA | | 101 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 |
| 13C8_PFOA | | 111 | 50-150 |
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 96 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-005**

Description: **VAP-VRTB-04_15.5-19.5** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1805** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 104 | 50-150 |
| d-MeFOSA | | 95 | 50-150 |
| d3-MeFOSAA | | 120 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-006**

Description: **VAP-VRTB-02_30-34** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1105** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2021 1911 | NK1 | 10/10/2021 1333 | 18279 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/16/2021 1451 | MMM | 10/15/2021 1251 | 18955 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **5.2** | **BJ** | **6.8** | 3.4 | **1.7** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **1.0** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **24** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **2.1** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **1.3** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **2.3** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **0.88** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **1.9** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **1.6** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **78** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 | H | 118 | 50-150 |
| 13C2_6:2FTS | | 94 | 50-150 | H | 122 | 50-150 |
| 13C2_8:2FTS | | 89 | 50-150 | H | 106 | 50-150 |
| 13C2_PFDoA | | 93 | 50-150 | H | 93 | 50-150 |
| 13C2_PFTeDA | | 93 | 50-150 | H | 96 | 50-150 |
| 13C3_PFBS | | 110 | 50-150 | H | 105 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 | H | 104 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 | H | 104 | 50-150 |
| 13C4_PFHpA | | 105 | 50-150 | H | 97 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 | H | 98 | 50-150 |
| 13C5_PFPeA | | 97 | 50-150 | H | 102 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 | H | 99 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 | H | 99 | 50-150 |
| 13C8_PFOA | | 107 | 50-150 | H | 108 | 50-150 |
| 13C8_PFOS | | 101 | 50-150 | H | 95 | 50-150 |
| 13C8_PFOSA | | 102 | 50-150 | H | 98 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-006**

Description: **VAP-VRTB-02_30-34** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1105** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 100 | 50-150 | H | 105 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 | H | 101 | 50-150 |
| d-MeFOSA | | 99 | 50-150 | H | 98 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 | H | 95 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-006**

Description: **VAP-VRTB-02_30-34** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1105** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2021 1911 | NK1 | 10/10/2021 1333 | 18279 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/16/2021 1451 | MMM | 10/15/2021 1251 | 18955 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 6.5 | UH | 13 | 6.5 | 3.4 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **0.85** | **HJ** | **3.4** | 1.7 | **0.84** | **ng/L** | **2** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **21** | **H** | **3.4** | 1.7 | **0.84** | **ng/L** | **2** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **1.9** | **HJ** | **3.4** | 1.7 | **0.84** | **ng/L** | **2** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **1.2** | **HJ** | **3.4** | 1.7 | **0.84** | **ng/L** | **2** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **2.0** | **HJ** | **3.4** | 1.7 | **0.84** | **ng/L** | **2** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **0.88** | **HJ** | **3.4** | 1.7 | **0.84** | **ng/L** | **2** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **1.7** | **HJ** | **3.4** | 1.7 | **0.84** | **ng/L** | **2** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **1.3** | **HJ** | **3.4** | 1.7 | **0.84** | **ng/L** | **2** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **71** | **H** | **3.4** | 1.7 | **0.84** | **ng/L** | **2** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 | H | 118 | 50-150 |
| 13C2_6:2FTS | | 94 | 50-150 | H | 122 | 50-150 |
| 13C2_8:2FTS | | 89 | 50-150 | H | 106 | 50-150 |
| 13C2_PFDoA | | 93 | 50-150 | H | 93 | 50-150 |
| 13C2_PFTeDA | | 93 | 50-150 | H | 96 | 50-150 |
| 13C3_PFBS | | 110 | 50-150 | H | 105 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 | H | 104 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 | H | 104 | 50-150 |
| 13C4_PFHpA | | 105 | 50-150 | H | 97 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 | H | 98 | 50-150 |
| 13C5_PFPeA | | 97 | 50-150 | H | 102 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 | H | 99 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 | H | 99 | 50-150 |
| 13C8_PFOA | | 107 | 50-150 | H | 108 | 50-150 |
| 13C8_PFOS | | 101 | 50-150 | H | 95 | 50-150 |
| 13C8_PFOSA | | 102 | 50-150 | H | 98 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-006**

Description: **VAP-VRTB-02_30-34** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1105** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 100 | 50-150 | H | 105 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 | H | 101 | 50-150 |
| d-MeFOSA | | 99 | 50-150 | H | 98 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 | H | 95 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-007**

Description: **VAP-VRTB-02_25-29** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1310** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2021 1921 | NK1 | 10/10/2021 1333 | 18279 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/19/2021 1230 | MMM | 10/15/2021 1251 | 18955 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **4.9** | **BJ** | **6.9** | 3.5 | **1.7** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **1.3** | **J** | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **1.1** | **J** | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **1.0** | **J** | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **31** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **3.6** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **3.6** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **2.8** | **J** | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **1.2** | **J** | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **4.2** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **2.4** | **J** | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **92** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 106 | 50-150 | H | 121 | 50-150 |
| 13C2_6:2FTS | | 90 | 50-150 | H | 105 | 50-150 |
| 13C2_8:2FTS | | 81 | 50-150 | H | 96 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 | H | 105 | 50-150 |
| 13C2_PFTeDA | | 93 | 50-150 | H | 102 | 50-150 |
| 13C3_PFBS | | 101 | 50-150 | H | 103 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 | H | 102 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 | H | 109 | 50-150 |
| 13C4_PFHpA | | 100 | 50-150 | H | 106 | 50-150 |
| 13C5_PFHxA | | 92 | 50-150 | H | 109 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 | H | 115 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 | H | 113 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 | H | 103 | 50-150 |
| 13C8_PFOA | | 108 | 50-150 | H | 109 | 50-150 |
| 13C8_PFOS | | 92 | 50-150 | H | 101 | 50-150 |
| 13C8_PFOSA | | 104 | 50-150 | H | 107 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-007**

Description: **VAP-VRTB-02_25-29** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1310** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 93 | 50-150 | H | 105 | 50-150 |
| d5-EtFOSAA | | 95 | 50-150 | H | 92 | 50-150 |
| d-MeFOSA | | 95 | 50-150 | H | 81 | 50-150 |
| d3-MeFOSAA | | 91 | 50-150 | H | 104 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-007**

Description: **VAP-VRTB-02_25-29** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1310** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2021 1921 | NK1 | 10/10/2021 1333 | 18279 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/19/2021 1230 | MMM | 10/15/2021 1251 | 18955 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **2.7** | **BHJ** | **6.7** | 3.4 | **1.7** | **ng/L** | **2** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 6.5 | UH | 13 | 6.5 | 3.3 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **1.3** | **HJ** | **3.3** | 1.7 | **0.83** | **ng/L** | **2** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UH | 3.3 | 1.7 | 0.83 | ng/L | 2 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **1.0** | **HJ** | **3.3** | 1.7 | **0.83** | **ng/L** | **2** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UH | 3.3 | 1.7 | 0.83 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UH | 3.3 | 1.7 | 0.83 | ng/L | 2 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **1.0** | **HJ** | **3.3** | 1.7 | **0.83** | **ng/L** | **2** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **31** | **H** | **3.3** | 1.7 | **0.83** | **ng/L** | **2** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **3.2** | **HJ** | **3.3** | 1.7 | **0.83** | **ng/L** | **2** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UH | 3.3 | 1.7 | 0.83 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UH | 3.3 | 1.7 | 0.83 | ng/L | 2 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **3.3** | **H** | **3.3** | 1.7 | **0.83** | **ng/L** | **2** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **2.5** | **HJ** | **3.3** | 1.7 | **0.83** | **ng/L** | **2** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **1.2** | **HJ** | **3.3** | 1.7 | **0.83** | **ng/L** | **2** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **4.4** | **H** | **3.3** | 1.7 | **0.83** | **ng/L** | **2** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **2.3** | **HJ** | **3.3** | 1.7 | **0.83** | **ng/L** | **2** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UH | 3.3 | 1.7 | 0.83 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UH | 3.3 | 1.7 | 0.83 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | UH | 3.3 | 1.7 | 0.83 | ng/L | 2 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **90** | **H** | **3.3** | 1.7 | **0.83** | **ng/L** | **2** |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 106 | 50-150 | H | 121 | 50-150 |
| 13C2_6:2FTS | | 90 | 50-150 | H | 105 | 50-150 |
| 13C2_8:2FTS | | 81 | 50-150 | H | 96 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 | H | 105 | 50-150 |
| 13C2_PFTeDA | | 93 | 50-150 | H | 102 | 50-150 |
| 13C3_PFBS | | 101 | 50-150 | H | 103 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 | H | 102 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 | H | 109 | 50-150 |
| 13C4_PFHpA | | 100 | 50-150 | H | 106 | 50-150 |
| 13C5_PFHxA | | 92 | 50-150 | H | 109 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 | H | 115 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 | H | 113 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 | H | 103 | 50-150 |
| 13C8_PFOA | | 108 | 50-150 | H | 109 | 50-150 |
| 13C8_PFOS | | 92 | 50-150 | H | 101 | 50-150 |
| 13C8_PFOSA | | 104 | 50-150 | H | 107 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-007**

Description: **VAP-VRTB-02_25-29** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1310** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 93 | 50-150 | H | 105 | 50-150 |
| d5-EtFOSAA | | 95 | 50-150 | H | 92 | 50-150 |
| d-MeFOSA | | 95 | 50-150 | H | 81 | 50-150 |
| d3-MeFOSAA | | 91 | 50-150 | H | 104 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-008**

Description: **VAP-VRTB-02_20-24** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1415** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2021 1932 | NK1 | 10/10/2021 1333 | 18279 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | UQ | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | UQ | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | UQ | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **1.6** | **J** | **4.0** | 2.0 | **0.99** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **2.6** | **J** | **4.0** | 2.0 | **0.99** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **2.0** | **J** | **4.0** | 2.0 | **0.99** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **59** | | **4.0** | 2.0 | **0.99** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **6.8** | | **4.0** | 2.0 | **0.99** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | UQ | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **7.4** | | **4.0** | 2.0 | **0.99** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **7.6** | | **4.0** | 2.0 | **0.99** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **1.2** | **J** | **4.0** | 2.0 | **0.99** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **10** | | **4.0** | 2.0 | **0.99** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **6.3** | | **4.0** | 2.0 | **0.99** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | UQ | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | UQ | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | UQ | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **85** | | **4.0** | 2.0 | **0.99** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 64 | 50-150 |
| 13C2_6:2FTS | | 63 | 50-150 |
| 13C2_8:2FTS | | 51 | 50-150 |
| 13C2_PFDoA | N | 36 | 50-150 |
| 13C2_PFTeDA | N | 37 | 50-150 |
| 13C3_PFBS | | 67 | 50-150 |
| 13C3_PFHxS | | 62 | 50-150 |
| 13C4_PFBA | | 67 | 50-150 |
| 13C4_PFHpA | | 64 | 50-150 |
| 13C5_PFHxA | | 62 | 50-150 |
| 13C5_PFPeA | | 63 | 50-150 |
| 13C6_PFDA | | 56 | 50-150 |
| 13C7_PFUdA | N | 45 | 50-150 |
| 13C8_PFOA | | 67 | 50-150 |
| 13C8_PFOS | | 60 | 50-150 |
| 13C8_PFOSA | | 62 | 50-150 |
| 13C9_PFNA | | 60 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-008**

Description: **VAP-VRTB-02_20-24** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1415** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | N | 44 | 50-150 |
| d-MeFOSA | N | 45 | 50-150 |
| d3-MeFOSAA | N | 49 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-009**

Description: **VAP-VRTB-02_15-19** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1535** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2021 1942 | NK1 | 10/10/2021 1333 | 18279 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| **1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)** | **39108-34-4** | **PFAS by ID SOP** | **3.8** | **JQ** | **9.2** | 4.6 | **2.3** | **ng/L** | **1** |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **2.5** | **BJ** | **9.2** | 4.6 | **2.3** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.6 | U | 9.2 | 4.6 | 2.3 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.6 | UQ | 9.2 | 4.6 | 2.3 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 9.0 | UQ | 18 | 9.0 | 4.6 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.6 | UQ | 9.2 | 4.6 | 2.3 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **2.3** | **J** | **4.6** | 2.3 | **1.2** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.3 | U | 4.6 | 2.3 | 1.2 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **3.3** | **J** | **4.6** | 2.3 | **1.2** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.3 | U | 4.6 | 2.3 | 1.2 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.3 | U | 4.6 | 2.3 | 1.2 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **1.9** | **J** | **4.6** | 2.3 | **1.2** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **72** | | **4.6** | 2.3 | **1.2** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **7.5** | | **4.6** | 2.3 | **1.2** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.3 | U | 4.6 | 2.3 | 1.2 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.3 | UQ | 4.6 | 2.3 | 1.2 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **12** | | **4.6** | 2.3 | **1.2** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **10** | | **4.6** | 2.3 | **1.2** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **2.5** | **J** | **4.6** | 2.3 | **1.2** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **9.4** | | **4.6** | 2.3 | **1.2** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **9.2** | | **4.6** | 2.3 | **1.2** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.3 | UQ | 4.6 | 2.3 | 1.2 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.3 | UQ | 4.6 | 2.3 | 1.2 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.3 | UQ | 4.6 | 2.3 | 1.2 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **650** | | **4.6** | 2.3 | **1.2** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 61 | 50-150 |
| 13C2_6:2FTS | | 50 | 50-150 |
| 13C2_8:2FTS | N | 44 | 50-150 |
| 13C2_PFDoA | N | 39 | 50-150 |
| 13C2_PFTeDA | N | 38 | 50-150 |
| 13C3_PFBS | | 64 | 50-150 |
| 13C3_PFHxS | | 57 | 50-150 |
| 13C4_PFBA | | 62 | 50-150 |
| 13C4_PFHpA | | 59 | 50-150 |
| 13C5_PFHxA | | 57 | 50-150 |
| 13C5_PFPeA | | 61 | 50-150 |
| 13C6_PFDA | | 52 | 50-150 |
| 13C7_PFUdA | N | 41 | 50-150 |
| 13C8_PFOA | | 60 | 50-150 |
| 13C8_PFOS | | 53 | 50-150 |
| 13C8_PFOSA | | 55 | 50-150 |
| 13C9_PFNA | | 53 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-009**

Description: **VAP-VRTB-02_15-19** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1535** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | N | 42 | 50-150 |
| d-MeFOSA | N | 49 | 50-150 |
| d3-MeFOSAA | N | 47 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-010**

Description: **VAP-VRTB-DUP-02** Matrix: **Aqueous**

Date Sampled: **09/14/2021** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/12/2021 1527 | JJG | 10/11/2021 1143 | 18329 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| **1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)** | **39108-34-4** | **PFAS by ID SOP** | **2.9** | **J** | **7.0** | 3.5 | **1.8** | **ng/L** | **1** |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **1.7** | **J** | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **2.3** | **J** | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **1.6** | **J** | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **54** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **5.3** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **8.8** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **7.5** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **2.2** | **J** | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **6.7** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **6.8** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **500** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 |
| 13C2_6:2FTS | N | 164 | 50-150 |
| 13C2_8:2FTS | | 88 | 50-150 |
| 13C2_PFDoA | | 60 | 50-150 |
| 13C2_PFTeDA | | 61 | 50-150 |
| 13C3_PFBS | | 90 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 98 | 50-150 |
| 13C5_PFHxA | | 100 | 50-150 |
| 13C5_PFPeA | | 98 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 75 | 50-150 |
| 13C8_PFOA | | 101 | 50-150 |
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 |
| 13C9_PFNA | | 90 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18005-010**

Description: **VAP-VRTB-DUP-02** Matrix: **Aqueous**

Date Sampled: **09/14/2021** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 74 | 50-150 |
| d-MeFOSA | | 55 | 50-150 |
| d3-MeFOSAA | | 84 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18205-001
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/09/2021 1824 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/09/2021 1824 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/09/2021 1824 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/09/2021 1824 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/09/2021 1824 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/09/2021 1824 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 94 | 50-150 |
| 13C2_6:2FTS | | 116 | 50-150 |
| 13C2_8:2FTS | | 79 | 50-150 |
| 13C2_PFDoA | | 74 | 50-150 |
| 13C2_PFTeDA | | 77 | 50-150 |
| 13C3_PFBS | | 88 | 50-150 |
| 13C3_PFHxS | | 83 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 84 | 50-150 |
| 13C5_PFHxA | | 88 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18205-001
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 84 | 50-150 |
| 13C8_PFOSA | | 90 | 50-150 |
| 13C9_PFNA | | 87 | 50-150 |
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 69 | 50-150 |
| d3-MeFOSAA | | 81 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18205-002
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 19 | | 1 | 127 | 67-138 | 10/09/2021 1835 |
| 6:2 FTS | 15 | 14 | | 1 | 94 | 64-140 | 10/09/2021 1835 |
| 4:2 FTS | 15 | 15 | | 1 | 104 | 63-143 | 10/09/2021 1835 |
| EtFOSAA | 16 | 17 | | 1 | 104 | 61-135 | 10/09/2021 1835 |
| MeFOSA | 16 | 16 | | 1 | 98 | 68-141 | 10/09/2021 1835 |
| MeFOSAA | 16 | 18 | | 1 | 110 | 65-136 | 10/09/2021 1835 |
| PFBS | 14 | 14 | | 1 | 101 | 72-130 | 10/09/2021 1835 |
| PFDS | 15 | 15 | | 1 | 99 | 53-142 | 10/09/2021 1835 |
| PFHpS | 15 | 16 | | 1 | 102 | 69-134 | 10/09/2021 1835 |
| PFNS | 15 | 18 | | 1 | 118 | 69-127 | 10/09/2021 1835 |
| PFOSA | 16 | 16 | | 1 | 101 | 67-137 | 10/09/2021 1835 |
| PFPeS | 15 | 15 | | 1 | 98 | 71-127 | 10/09/2021 1835 |
| PFHxS | 15 | 15 | | 1 | 100 | 68-131 | 10/09/2021 1835 |
| PFBA | 16 | 16 | | 1 | 103 | 73-129 | 10/09/2021 1835 |
| PFDA | 16 | 16 | | 1 | 98 | 71-129 | 10/09/2021 1835 |
| PFDoA | 16 | 16 | | 1 | 102 | 72-134 | 10/09/2021 1835 |
| PFHpA | 16 | 16 | | 1 | 100 | 72-130 | 10/09/2021 1835 |
| PFHxA | 16 | 15 | | 1 | 97 | 72-129 | 10/09/2021 1835 |
| PFNA | 16 | 16 | | 1 | 103 | 69-130 | 10/09/2021 1835 |
| PFOA | 16 | 16 | | 1 | 102 | 71-133 | 10/09/2021 1835 |
| PFPeA | 16 | 16 | | 1 | 102 | 72-129 | 10/09/2021 1835 |
| PFTeDA | 16 | 16 | | 1 | 103 | 71-132 | 10/09/2021 1835 |
| PFTrDA | 16 | 17 | | 1 | 104 | 65-144 | 10/09/2021 1835 |
| PFUdA | 16 | 17 | | 1 | 107 | 69-133 | 10/09/2021 1835 |
| PFOS | 15 | 16 | | 1 | 106 | 65-140 | 10/09/2021 1835 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 86 | 50-150 |
| 13C2_6:2FTS | N | 165 | 50-150 |
| 13C2_8:2FTS | | 69 | 50-150 |
| 13C2_PFDoA | | 69 | 50-150 |
| 13C2_PFTeDA | | 78 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 |
| 13C3_PFHxS | | 79 | 50-150 |
| 13C4_PFBA | | 81 | 50-150 |
| 13C4_PFHpA | | 81 | 50-150 |
| 13C5_PFHxA | | 86 | 50-150 |
| 13C5_PFPeA | | 84 | 50-150 |
| 13C6_PFDA | | 84 | 50-150 |
| 13C7_PFUdA | | 75 | 50-150 |
| 13C8_PFOA | | 86 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18205-002
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 75 | 50-150 |
| 13C8_PFOSA | | 81 | 50-150 |
| 13C9_PFNA | | 79 | 50-150 |
| d5-EtFOSAA | | 75 | 50-150 |
| d-MeFOSA | | 62 | 50-150 |
| d3-MeFOSAA | | 79 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18279-001
**Batch:** 18279
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/10/2021 1333

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2021 1736 |
| **6:2 FTS** | **11** | | **1** | **8.0** | 4.0 | **2.0** | **ng/L** | **10/11/2021 1736** |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2021 1736 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2021 1736 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/11/2021 1736 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2021 1736 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2021 1736 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | N | 155 | 50-150 |
| 13C2_6:2FTS | | 144 | 50-150 |
| 13C2_8:2FTS | N | 162 | 50-150 |
| 13C2_PFDoA | | 108 | 50-150 |
| 13C2_PFTeDA | | 92 | 50-150 |
| 13C3_PFBS | | 105 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 |
| 13C4_PFBA | | 112 | 50-150 |
| 13C4_PFHpA | | 104 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 |
| 13C5_PFPeA | | 101 | 50-150 |
| 13C6_PFDA | | 95 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 102 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18279-001
**Batch:** 18279
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/10/2021 1333

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 97 | 50-150 |
| 13C8_PFOSA | | 84 | 50-150 |
| 13C9_PFNA | | 90 | 50-150 |
| d5-EtFOSAA | | 105 | 50-150 |
| d-MeFOSA | | 100 | 50-150 |
| d3-MeFOSAA | | 95 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18279-002
**Batch:** 18279
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/10/2021 1333

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 14 | | 1 | 92 | 67-138 | 10/11/2021 1746 |
| 6:2 FTS | 15 | 18 | | 1 | 119 | 64-140 | 10/11/2021 1746 |
| 4:2 FTS | 15 | 14 | | 1 | 97 | 63-143 | 10/11/2021 1746 |
| EtFOSAA | 16 | 16 | | 1 | 99 | 61-135 | 10/11/2021 1746 |
| MeFOSA | 16 | 19 | | 1 | 121 | 68-141 | 10/11/2021 1746 |
| MeFOSAA | 16 | 17 | | 1 | 108 | 65-136 | 10/11/2021 1746 |
| PFBS | 14 | 14 | | 1 | 101 | 72-130 | 10/11/2021 1746 |
| PFDS | 15 | 14 | | 1 | 90 | 53-142 | 10/11/2021 1746 |
| PFHpS | 15 | 13 | | 1 | 83 | 69-134 | 10/11/2021 1746 |
| PFNS | 15 | 15 | | 1 | 97 | 69-127 | 10/11/2021 1746 |
| PFOSA | 16 | 16 | | 1 | 98 | 67-137 | 10/11/2021 1746 |
| PFPeS | 15 | 15 | | 1 | 103 | 71-127 | 10/11/2021 1746 |
| PFHxS | 15 | 12 | | 1 | 81 | 68-131 | 10/11/2021 1746 |
| PFBA | 16 | 16 | | 1 | 97 | 73-129 | 10/11/2021 1746 |
| PFDA | 16 | 17 | | 1 | 108 | 71-129 | 10/11/2021 1746 |
| PFDoA | 16 | 15 | | 1 | 93 | 72-134 | 10/11/2021 1746 |
| PFHpA | 16 | 18 | | 1 | 111 | 72-130 | 10/11/2021 1746 |
| PFHxA | 16 | 16 | | 1 | 101 | 72-129 | 10/11/2021 1746 |
| PFNA | 16 | 16 | | 1 | 99 | 69-130 | 10/11/2021 1746 |
| PFOA | 16 | 14 | | 1 | 90 | 71-133 | 10/11/2021 1746 |
| PFPeA | 16 | 15 | | 1 | 95 | 72-129 | 10/11/2021 1746 |
| PFTeDA | 16 | 17 | | 1 | 104 | 71-132 | 10/11/2021 1746 |
| PFTrDA | 16 | 14 | | 1 | 90 | 65-144 | 10/11/2021 1746 |
| PFUdA | 16 | 16 | | 1 | 99 | 69-133 | 10/11/2021 1746 |
| PFOS | 15 | 15 | | 1 | 102 | 65-140 | 10/11/2021 1746 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 |
| 13C2_6:2FTS | | 92 | 50-150 |
| 13C2_8:2FTS | | 82 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 |
| 13C2_PFTeDA | | 83 | 50-150 |
| 13C3_PFBS | | 84 | 50-150 |
| 13C3_PFHxS | | 90 | 50-150 |
| 13C4_PFBA | | 88 | 50-150 |
| 13C4_PFHpA | | 86 | 50-150 |
| 13C5_PFHxA | | 83 | 50-150 |
| 13C5_PFPeA | | 83 | 50-150 |
| 13C6_PFDA | | 84 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 86 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18279-002
**Batch:** 18279
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/10/2021 1333

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 82 | 50-150 |
| 13C8_PFOSA | | 78 | 50-150 |
| 13C9_PFNA | | 79 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 |
| d-MeFOSA | | 71 | 50-150 |
| d3-MeFOSAA | | 85 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - Duplicate

**Sample ID:** WI18005-003DU
**Batch:** 18279
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/10/2021 1333

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| 6:2 FTS | 7.3 | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| 4:2 FTS | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| EtFOSAA | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| MeFOSA | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| MeFOSAA | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| PFBS | 3.5 | 3.9 | | 1 | 9.2 | 20 | 10/11/2021 1829 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| PFHpS | 16 | 19 | | 1 | 13 | 20 | 10/11/2021 1829 |
| PFNS | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| PFOSA | 0.95 | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| PFPeS | 7.4 | 6.8 | | 1 | 8.5 | 20 | 10/11/2021 1829 |
| PFHxS | 150 | 170 | | 1 | 8.4 | 20 | 10/11/2021 1829 |
| PFBA | 4.4 | 4.4 | | 1 | 0.41 | 20 | 10/11/2021 1829 |
| PFDA | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| PFHpA | 5.0 | 4.7 | | 1 | 6.5 | 20 | 10/11/2021 1829 |
| PFHxA | 7.3 | 8.5 | | 1 | 14 | 20 | 10/11/2021 1829 |
| PFNA | 3.7 | 3.9 | | 1 | 4.7 | 20 | 10/11/2021 1829 |
| PFOA | 15 | 15 | | 1 | 1.6 | 20 | 10/11/2021 1829 |
| PFPeA | 4.8 | 4.5 | | 1 | 6.6 | 20 | 10/11/2021 1829 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| PFUdA | ND | ND | | 1 | 0.00 | 20 | 10/11/2021 1829 |
| PFOS | 1100 | 1000 | E | 1 | 3.1 | 20 | 10/11/2021 1829 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 |
| 13C2_6:2FTS | | 106 | 50-150 |
| 13C2_8:2FTS | | 96 | 50-150 |
| 13C2_PFDoA | | 81 | 50-150 |
| 13C2_PFTeDA | | 68 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 |
| 13C3_PFHxS | | 74 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 |
| 13C4_PFHpA | | 91 | 50-150 |
| 13C5_PFHxA | | 76 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - Duplicate

**Sample ID:** WI18005-003DU
**Batch:** 18279
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/10/2021 1333

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 84 | 50-150 |
| 13C8_PFOSA | | 102 | 50-150 |
| 13C9_PFNA | | 84 | 50-150 |
| d5-EtFOSAA | | 89 | 50-150 |
| d-MeFOSA | | 77 | 50-150 |
| d3-MeFOSAA | | 111 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MS

**Sample ID:** WI18005-004MS
**Batch:** 18279
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/10/2021 1333

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 1.9 | 16 | 22 | | 1 | 135 | 67-138 | 10/11/2021 1850 |
| 6:2 FTS | 2.2 | 16 | 16 | | 1 | 86 | 64-140 | 10/11/2021 1850 |
| 4:2 FTS | ND | 16 | 16 | | 1 | 102 | 63-143 | 10/11/2021 1850 |
| EtFOSAA | ND | 17 | 17 | | 1 | 104 | 61-135 | 10/11/2021 1850 |
| MeFOSA | ND | 17 | 23 | | 1 | 139 | 68-141 | 10/11/2021 1850 |
| MeFOSAA | ND | 17 | 17 | | 1 | 104 | 65-136 | 10/11/2021 1850 |
| PFBS | 11 | 15 | 27 | | 1 | 106 | 72-130 | 10/11/2021 1850 |
| PFDS | ND | 16 | 14 | | 1 | 90 | 53-142 | 10/11/2021 1850 |
| PFHpS | 78 | 16 | 100 | N | 1 | 166 | 69-134 | 10/11/2021 1850 |
| PFNS | ND | 16 | 16 | | 1 | 101 | 69-127 | 10/11/2021 1850 |
| PFOSA | 1.3 | 17 | 16 | | 1 | 88 | 67-137 | 10/11/2021 1850 |
| PFPeS | 32 | 16 | 50 | | 1 | 115 | 71-127 | 10/11/2021 1850 |
| PFHxS | 860 | 15 | 990 | N | 1 | 870 | 68-131 | 10/11/2021 1850 |
| PFBA | 9.2 | 17 | 26 | | 1 | 101 | 73-129 | 10/11/2021 1850 |
| PFDA | ND | 17 | 18 | | 1 | 106 | 71-129 | 10/11/2021 1850 |
| PFDoA | ND | 17 | 17 | | 1 | 104 | 72-134 | 10/11/2021 1850 |
| PFHpA | 14 | 17 | 32 | | 1 | 108 | 72-130 | 10/11/2021 1850 |
| PFHxA | 25 | 17 | 46 | | 1 | 126 | 72-129 | 10/11/2021 1850 |
| PFNA | 8.4 | 17 | 27 | | 1 | 114 | 69-130 | 10/11/2021 1850 |
| PFOA | 55 | 17 | 83 | N | 1 | 168 | 71-133 | 10/11/2021 1850 |
| PFPeA | 12 | 17 | 29 | | 1 | 102 | 72-129 | 10/11/2021 1850 |
| PFTeDA | ND | 17 | 17 | | 1 | 104 | 71-132 | 10/11/2021 1850 |
| PFTrDA | ND | 17 | 15 | | 1 | 89 | 65-144 | 10/11/2021 1850 |
| PFUdA | ND | 17 | 18 | | 1 | 111 | 69-133 | 10/11/2021 1850 |
| PFOS | 2700 | 16 | 3200 | N | 1 | 3220 | 65-140 | 10/11/2021 1850 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 78 | 50-150 |
| 13C2_6:2FTS | | 69 | 50-150 |
| 13C2_8:2FTS | | 64 | 50-150 |
| 13C2_PFDoA | | 59 | 50-150 |
| 13C2_PFTeDA | N | 49 | 50-150 |
| 13C3_PFBS | | 72 | 50-150 |
| 13C3_PFHxS | | 62 | 50-150 |
| 13C4_PFBA | | 73 | 50-150 |
| 13C4_PFHpA | | 65 | 50-150 |
| 13C5_PFHxA | | 68 | 50-150 |
| 13C5_PFPeA | | 69 | 50-150 |
| 13C6_PFDA | | 69 | 50-150 |
| 13C7_PFUdA | | 57 | 50-150 |
| 13C8_PFOA | | 65 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MS

**Sample ID:** WI18005-004MS
**Batch:** 18279
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/10/2021 1333

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 60 | 50-150 |
| 13C8_PFOSA | | 79 | 50-150 |
| 13C9_PFNA | | 58 | 50-150 |
| d5-EtFOSAA | | 63 | 50-150 |
| d-MeFOSA | | 58 | 50-150 |
| d3-MeFOSAA | | 69 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18329-001
**Batch:** 18329
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/11/2021 1143

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/12/2021 1342 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/12/2021 1342 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/12/2021 1342 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/12/2021 1342 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/12/2021 1342 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/12/2021 1342 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 92 | 50-150 |
| 13C2_6:2FTS | | 104 | 50-150 |
| 13C2_8:2FTS | | 92 | 50-150 |
| 13C2_PFDoA | | 85 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 |
| 13C3_PFBS | | 87 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 90 | 50-150 |
| 13C6_PFDA | | 89 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18329-001
**Batch:** 18329
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/11/2021 1143

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 92 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 |
| 13C9_PFNA | | 88 | 50-150 |
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 88 | 50-150 |
| d3-MeFOSAA | | 89 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18329-002
**Batch:** 18329
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/11/2021 1143

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 13 | | 1 | 87 | 67-138 | 10/12/2021 1352 |
| 6:2 FTS | 15 | 16 | | 1 | 108 | 64-140 | 10/12/2021 1352 |
| 4:2 FTS | 15 | 14 | | 1 | 96 | 63-143 | 10/12/2021 1352 |
| EtFOSAA | 16 | 15 | | 1 | 95 | 61-135 | 10/12/2021 1352 |
| MeFOSA | 16 | 17 | | 1 | 106 | 68-141 | 10/12/2021 1352 |
| MeFOSAA | 16 | 15 | | 1 | 96 | 65-136 | 10/12/2021 1352 |
| PFBS | 14 | 14 | | 1 | 97 | 72-130 | 10/12/2021 1352 |
| PFDS | 15 | 16 | | 1 | 101 | 53-142 | 10/12/2021 1352 |
| PFHpS | 15 | 15 | | 1 | 98 | 69-134 | 10/12/2021 1352 |
| PFNS | 15 | 17 | | 1 | 109 | 69-127 | 10/12/2021 1352 |
| PFOSA | 16 | 15 | | 1 | 92 | 67-137 | 10/12/2021 1352 |
| PFPeS | 15 | 14 | | 1 | 93 | 71-127 | 10/12/2021 1352 |
| PFHxS | 15 | 14 | | 1 | 97 | 68-131 | 10/12/2021 1352 |
| PFBA | 16 | 15 | | 1 | 96 | 73-129 | 10/12/2021 1352 |
| PFDA | 16 | 16 | | 1 | 97 | 71-129 | 10/12/2021 1352 |
| PFDoA | 16 | 15 | | 1 | 93 | 72-134 | 10/12/2021 1352 |
| PFHpA | 16 | 15 | | 1 | 95 | 72-130 | 10/12/2021 1352 |
| PFHxA | 16 | 15 | | 1 | 97 | 72-129 | 10/12/2021 1352 |
| PFNA | 16 | 15 | | 1 | 92 | 69-130 | 10/12/2021 1352 |
| PFOA | 16 | 15 | | 1 | 94 | 71-133 | 10/12/2021 1352 |
| PFPeA | 16 | 15 | | 1 | 94 | 72-129 | 10/12/2021 1352 |
| PFTeDA | 16 | 16 | | 1 | 100 | 71-132 | 10/12/2021 1352 |
| PFTrDA | 16 | 16 | | 1 | 99 | 65-144 | 10/12/2021 1352 |
| PFUdA | 16 | 16 | | 1 | 101 | 69-133 | 10/12/2021 1352 |
| PFOS | 15 | 16 | | 1 | 110 | 65-140 | 10/12/2021 1352 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 102 | 50-150 |
| 13C2_6:2FTS | | 103 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 |
| 13C2_PFDoA | | 90 | 50-150 |
| 13C2_PFTeDA | | 99 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 |
| 13C3_PFHxS | | 99 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 |
| 13C7_PFUdA | | 98 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18329-002
**Batch:** 18329
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/11/2021 1143

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 94 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 |
| 13C9_PFNA | | 94 | 50-150 |
| d5-EtFOSAA | | 101 | 50-150 |
| d-MeFOSA | | 94 | 50-150 |
| d3-MeFOSAA | | 96 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18955-001
**Batch:** 18955
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/15/2021 1251

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/16/2021 1305 |
| **6:2 FTS** | **13** | | **1** | **8.0** | 4.0 | **2.0** | **ng/L** | **10/16/2021 1305** |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/16/2021 1305 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/16/2021 1305 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/16/2021 1305 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/16/2021 1305 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/16/2021 1305 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 108 | 50-150 |
| 13C2_6:2FTS | | 97 | 50-150 |
| 13C2_8:2FTS | | 87 | 50-150 |
| 13C2_PFDoA | | 91 | 50-150 |
| 13C2_PFTeDA | | 83 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 |
| 13C5_PFHxA | | 89 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 |
| 13C6_PFDA | | 99 | 50-150 |
| 13C7_PFUdA | | 96 | 50-150 |
| 13C8_PFOA | | 97 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18955-001
**Batch:** 18955
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/15/2021 1251

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 83 | 50-150 |
| 13C8_PFOSA | | 84 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 74 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18955-002
**Batch:** 18955
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/15/2021 1251

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 18 | | 1 | 115 | 67-138 | 10/16/2021 1315 |
| 6:2 FTS | 15 | 18 | | 1 | 116 | 64-140 | 10/16/2021 1315 |
| 4:2 FTS | 15 | 13 | | 1 | 86 | 63-143 | 10/16/2021 1315 |
| EtFOSAA | 16 | 16 | | 1 | 98 | 61-135 | 10/16/2021 1315 |
| MeFOSA | 16 | 17 | | 1 | 108 | 68-141 | 10/16/2021 1315 |
| MeFOSAA | 16 | 15 | | 1 | 96 | 65-136 | 10/16/2021 1315 |
| PFBS | 14 | 13 | | 1 | 91 | 72-130 | 10/16/2021 1315 |
| PFDS | 15 | 14 | | 1 | 92 | 53-142 | 10/16/2021 1315 |
| PFHpS | 15 | 15 | | 1 | 102 | 69-134 | 10/16/2021 1315 |
| PFNS | 15 | 15 | | 1 | 101 | 69-127 | 10/16/2021 1315 |
| PFOSA | 16 | 15 | | 1 | 91 | 67-137 | 10/16/2021 1315 |
| PFPeS | 15 | 14 | | 1 | 93 | 71-127 | 10/16/2021 1315 |
| PFHxS | 15 | 14 | | 1 | 97 | 68-131 | 10/16/2021 1315 |
| PFBA | 16 | 16 | | 1 | 97 | 73-129 | 10/16/2021 1315 |
| PFDA | 16 | 20 | | 1 | 127 | 71-129 | 10/16/2021 1315 |
| PFDoA | 16 | 16 | | 1 | 100 | 72-134 | 10/16/2021 1315 |
| PFHpA | 16 | 15 | | 1 | 91 | 72-130 | 10/16/2021 1315 |
| PFHxA | 16 | 16 | | 1 | 98 | 72-129 | 10/16/2021 1315 |
| PFNA | 16 | 19 | | 1 | 116 | 69-130 | 10/16/2021 1315 |
| PFOA | 16 | 16 | | 1 | 99 | 71-133 | 10/16/2021 1315 |
| PFPeA | 16 | 15 | | 1 | 96 | 72-129 | 10/16/2021 1315 |
| PFTeDA | 16 | 17 | | 1 | 104 | 71-132 | 10/16/2021 1315 |
| PFTrDA | 16 | 16 | | 1 | 98 | 65-144 | 10/16/2021 1315 |
| PFUdA | 16 | 16 | | 1 | 98 | 69-133 | 10/16/2021 1315 |
| PFOS | 15 | 15 | | 1 | 103 | 65-140 | 10/16/2021 1315 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 104 | 50-150 |
| 13C2_6:2FTS | | 95 | 50-150 |
| 13C2_8:2FTS | | 86 | 50-150 |
| 13C2_PFDoA | | 83 | 50-150 |
| 13C2_PFTeDA | | 85 | 50-150 |
| 13C3_PFBS | | 90 | 50-150 |
| 13C3_PFHxS | | 99 | 50-150 |
| 13C4_PFBA | | 94 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 |
| 13C5_PFHxA | | 89 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18955-002
**Batch:** 18955
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/15/2021 1251

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 84 | 50-150 |
| 13C8_PFOSA | | 93 | 50-150 |
| 13C9_PFNA | | 82 | 50-150 |
| d5-EtFOSAA | | 90 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# Chain of Custody
# and
# Miscellaneous Documents

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 124644

| | | | |
|---|---|---|---|
| Client: Aradas | Report to Contact: Kristen Haskamp / Patrick Curry | Telephone No. / E-mail: 281-534-5692 / kristen.haskamp@arcadis.com; 734-355-2809 / patrick.curry@arcadis.com | Quote No. |
| Address: 28550 Cabot Dr #500 | Sampler's Signature: | Analysis (Attach list if more space is needed) | Page 1 of |
| City: Novi | State: MI | Zip Code: 48377 | Sampler's Printed Name: Madison Olenick |
| Project Name: 300 GAAF ESTCP Vertebrae | | | |
| Project No.: 30027244 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Sample Condition (Lab Use Only) | Matrix: Aqueous | Matrix: Solid | Matrix: Non-Aqueous | No. of Containers by Preservative Type: Unpres. | HCl | HNO3 | H2SO4 | NaOH | Na2S2O3 | Other | Analyses Requested: PFAS via ASTM D7979 Modified (Non-Potable) | Remarks / Cooler ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VAP-VRTB-04_36-40 | 9/13/2021 | 1200 | G | X | | | 2 | | | | | | | X | |
| VAP-VRTB-04_29-33 | | 1530 | | | | | | | | | | | | | |
| VAP-VRTB-04_23.5-27.5 | | 1630 | | | | | | | | | | | | | |
| VAP-VRTB-04_19.5-23.5 | | 1710 | | | | | | | | | | | | | |
| VAP-VRTB-04_15.5-19.5 | | 1805 | | | | | | | | | | | | | |
| VAP-VRTB-02_30-34 | 9/14/2021 | 1105 | | | | | | | | | | | | | |
| VAP-VRTB-02_25-29 | | 1310 | | | | | | | | | | | | | |
| VAP-VRTB-02_20-24 | | 1415 | | | | | | | | | | | | | |
| VAP-VRTB-02_15-19 | | 1535 | | | | | | | | | | | | | |
| VAP-VRTB-Dup-02 | | — | | | | | | | | | | | | | |

WI18005

KES2

Turn Around Time Required (Prior lab approval required for expedited TAT): [X] Standard [ ] Rush (Specify)

Sample Disposal: [ ] Return to Client [X] Disposal by Lab

Possible Hazard Identification: [ ] Non-Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison [ ] Unknown

QC Requirements (Specify)

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by | 9/17/21 | 1030 | 1. Received by | | |
| 2. Relinquished by | | | 2. Received by | | |
| 3. Relinquished by | | | 3. Received by | | |
| 4. Relinquished by: Fedex | 9/18/21 | 0930 | 4. Laboratory Received by: Greg Anderson | 9/18/21 | 0930 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY

Received on ice (Circle): (Yes) No Ice Pack — Receipt Temp. 3.5 °C — Temp Blank: [X] Y [ ] N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: MC003N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised: 9/29/2020


# Sample Receipt Checklist (SRC)

Client: ARCADIS  Cooler Inspected by/date: JRG2 / 09/18/2021  Lot #: WI18035

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No | ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: NA

3.5 / 3.5 °C  NA / NA °C  NA / NA °C  NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles  IR Gun ID: 5  IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☐ Yes | ☐ No | ☑ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☐ Yes | ☑ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼" or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc...) correctly transcribed from the COC into the comment section in LIMS? |
| ☐ Yes | ☑ No | | 21. Was the quote number listed on the container label? If yes, Quote # NA |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2  Date: 09/18/2021

Comments:

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP GAAF Vertebrae

Project Number: 30027244

Lot Number:**WI18006**

Date Completed:10/24/2021

11/03/2021 5:13 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: WI18006

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

Samples WI18006-001, WI18006-003, WI18006-006 required centrifugation prior to extraction, due to excessive solids present in the samples. Centrifugation was performed following the PFAS Aqueous Centrifuge Protocol; samples were spiked with Surrogate (SUR; Extracted Internal Standard/EIS) and shaken vigorously before being poured into 6 50mL tubes and centrifuged. The centrifuged aqueous sample was decanted back into the original sample bottle, off of the condensed solids remaining in the centrifuge tubes. Original sample bottle was rinsed as normal and centrifuge tubes were rinsed with 0.5mL of MeOH each (total of 3mL). Centrifuge bottle rinsate was added to the elution. Samples concentrated to <10mL and reconstituted to 10mL using MeOH by transfer pipet.

Surrogate recovery for the following sample was outside the upper control limit: WI18006-002. This sample did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

Surrogate recovery for the following sample was outside control limits: WI18006-003. Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

## Sample Summary
## Arcadis U.S., Inc.
### Lot Number: WI18006

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | VAP-VRTB-03_36-40 | Aqueous | 09/16/2021 1050 | 09/18/2021 |
| 002 | VAP-VRTB-03_32-36 | Aqueous | 09/16/2021 1255 | 09/18/2021 |
| 003 | VAP-VRTB-03_27.5-31.5 | Aqueous | 09/16/2021 1355 | 09/18/2021 |
| 004 | VAP-VRTB-03_23-27 | Aqueous | 09/16/2021 1455 | 09/18/2021 |
| 005 | VAP-VRTB-03_19-23 | Aqueous | 09/16/2021 1540 | 09/18/2021 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | 09/16/2021 1640 | 09/18/2021 |

(6 samples)

## Detection Summary

## Arcadis U.S., Inc.

### Lot Number: WI18006

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | VAP-VRTB-03_36-40 | Aqueous | PFPeS | PFAS by ID | 3.5 | | ng/L | 7 |
| 001 | VAP-VRTB-03_36-40 | Aqueous | PFHxS | PFAS by ID | 39 | | ng/L | 7 |
| 001 | VAP-VRTB-03_36-40 | Aqueous | PFBA | PFAS by ID | 2.4 | J | ng/L | 7 |
| 001 | VAP-VRTB-03_36-40 | Aqueous | PFHpA | PFAS by ID | 1.1 | J | ng/L | 7 |
| 001 | VAP-VRTB-03_36-40 | Aqueous | PFHxA | PFAS by ID | 4.1 | | ng/L | 7 |
| 001 | VAP-VRTB-03_36-40 | Aqueous | PFOA | PFAS by ID | 2.1 | J | ng/L | 7 |
| 001 | VAP-VRTB-03_36-40 | Aqueous | PFPeA | PFAS by ID | 2.1 | J | ng/L | 7 |
| 001 | VAP-VRTB-03_36-40 | Aqueous | PFOS | PFAS by ID | 16 | | ng/L | 7 |
| 002 | VAP-VRTB-03_32-36 | Aqueous | PFBS | PFAS by ID | 6.6 | | ng/L | 9 |
| 002 | VAP-VRTB-03_32-36 | Aqueous | PFHpS | PFAS by ID | 2.1 | J | ng/L | 9 |
| 002 | VAP-VRTB-03_32-36 | Aqueous | PFPeS | PFAS by ID | 8.3 | | ng/L | 9 |
| 002 | VAP-VRTB-03_32-36 | Aqueous | PFHxS | PFAS by ID | 110 | | ng/L | 9 |
| 002 | VAP-VRTB-03_32-36 | Aqueous | PFBA | PFAS by ID | 7.0 | | ng/L | 9 |
| 002 | VAP-VRTB-03_32-36 | Aqueous | PFHpA | PFAS by ID | 5.2 | | ng/L | 9 |
| 002 | VAP-VRTB-03_32-36 | Aqueous | PFHxA | PFAS by ID | 11 | | ng/L | 9 |
| 002 | VAP-VRTB-03_32-36 | Aqueous | PFOA | PFAS by ID | 8.5 | | ng/L | 9 |
| 002 | VAP-VRTB-03_32-36 | Aqueous | PFPeA | PFAS by ID | 7.2 | | ng/L | 9 |
| 002 | VAP-VRTB-03_32-36 | Aqueous | PFOS | PFAS by ID | 52 | | ng/L | 9 |
| 004 | VAP-VRTB-03_23-27 | Aqueous | PFPeS | PFAS by ID | 10 | J | ng/L | 13 |
| 004 | VAP-VRTB-03_23-27 | Aqueous | PFHxS | PFAS by ID | 160 | | ng/L | 13 |
| 004 | VAP-VRTB-03_23-27 | Aqueous | PFBA | PFAS by ID | 19 | J | ng/L | 13 |
| 004 | VAP-VRTB-03_23-27 | Aqueous | PFHpA | PFAS by ID | 18 | J | ng/L | 13 |
| 004 | VAP-VRTB-03_23-27 | Aqueous | PFHxA | PFAS by ID | 31 | J | ng/L | 13 |
| 004 | VAP-VRTB-03_23-27 | Aqueous | PFOA | PFAS by ID | 24 | J | ng/L | 13 |
| 004 | VAP-VRTB-03_23-27 | Aqueous | PFPeA | PFAS by ID | 29 | J | ng/L | 13 |
| 004 | VAP-VRTB-03_23-27 | Aqueous | PFOS | PFAS by ID | 1200 | | ng/L | 13 |
| 005 | VAP-VRTB-03_19-23 | Aqueous | PFHxS | PFAS by ID | 1400 | | ng/L | 15 |
| 005 | VAP-VRTB-03_19-23 | Aqueous | PFHpA | PFAS by ID | 91 | J | ng/L | 15 |
| 005 | VAP-VRTB-03_19-23 | Aqueous | PFHxA | PFAS by ID | 190 | J | ng/L | 15 |
| 005 | VAP-VRTB-03_19-23 | Aqueous | PFOA | PFAS by ID | 160 | J | ng/L | 15 |
| 005 | VAP-VRTB-03_19-23 | Aqueous | PFPeA | PFAS by ID | 100 | J | ng/L | 15 |
| 005 | VAP-VRTB-03_19-23 | Aqueous | PFOS | PFAS by ID | 18000 | | ng/L | 15 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | 8:2 FTS | PFAS by ID | 2.1 | J | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | 6:2 FTS | PFAS by ID | 2.4 | J | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | PFBS | PFAS by ID | 73 | | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | PFHpS | PFAS by ID | 4.9 | | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | PFPeS | PFAS by ID | 3.5 | | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | PFHxS | PFAS by ID | 90 | | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | PFBA | PFAS by ID | 21 | | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | PFHpA | PFAS by ID | 59 | | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | PFHxA | PFAS by ID | 40 | | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | PFNA | PFAS by ID | 7.2 | | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | PFOA | PFAS by ID | 53 | | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | PFPeA | PFAS by ID | 47 | | ng/L | 17 |
| 006 | VAP-VRTB-03_15-19 | Aqueous | PFOS | PFAS by ID | 760 | B | ng/L | 17 |

# Detection Summary (Continued)

## Lot Number: WI18006

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|

(45 detections)

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18006-001**

Description: **VAP-VRTB-03_36-40** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1050**

Date Received: **09/18/2021**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/14/2021 1534 | JJG | 10/12/2021 1201 | 18442 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **3.5** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **39** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **2.4** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **1.1** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **4.1** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **2.1** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **2.1** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **16** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 124 | 50-150 |
| 13C2_6:2FTS | | 123 | 50-150 |
| 13C2_8:2FTS | | 111 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 |
| 13C2_PFTeDA | | 70 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 |
| 13C3_PFHxS | | 87 | 50-150 |
| 13C4_PFBA | | 91 | 50-150 |
| 13C4_PFHpA | | 86 | 50-150 |
| 13C5_PFHxA | | 89 | 50-150 |
| 13C5_PFPeA | | 90 | 50-150 |
| 13C6_PFDA | | 92 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 |
| 13C8_PFOA | | 87 | 50-150 |
| 13C8_PFOS | | 81 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 |
| 13C9_PFNA | | 94 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WI18006-001**
Description: **VAP-VRTB-03_36-40**
Matrix: **Aqueous**
Date Sampled: **09/16/2021 1050**
Date Received: **09/18/2021**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 95 | 50-150 |
| d-MeFOSA | | 86 | 50-150 |
| d3-MeFOSAA | | 110 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18006-002**

Description: **VAP-VRTB-03_32-36** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1255**

Date Received: **09/18/2021**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/14/2021 1544 | JJG | 10/12/2021 1201 | 18442 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **6.6** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **2.1** | **J** | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **8.3** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **110** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **7.0** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **5.2** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **11** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **8.5** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **7.2** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **52** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 146 | 50-150 |
| 13C2_6:2FTS | N | 164 | 50-150 |
| 13C2_8:2FTS | | 140 | 50-150 |
| 13C2_PFDoA | | 89 | 50-150 |
| 13C2_PFTeDA | | 88 | 50-150 |
| 13C3_PFBS | | 105 | 50-150 |
| 13C3_PFHxS | | 103 | 50-150 |
| 13C4_PFBA | | 104 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 108 | 50-150 |
| 13C7_PFUdA | | 92 | 50-150 |
| 13C8_PFOA | | 105 | 50-150 |
| 13C8_PFOS | | 95 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 101 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WI18006-002**
Description: **VAP-VRTB-03_32-36**
Matrix: **Aqueous**
Date Sampled: **09/16/2021 1255**
Date Received: **09/18/2021**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 102 | 50-150 |
| d-MeFOSA | | 95 | 50-150 |
| d3-MeFOSAA | | 128 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18006-003**

Description: **VAP-VRTB-03_27.5-31.5** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1355**

Date Received: **09/18/2021**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/14/2021 1555 | JJG | 10/12/2021 1201 | 18442 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 92 | 50-150 |
| 13C2_6:2FTS | N | 166 | 50-150 |
| 13C2_8:2FTS | | 65 | 50-150 |
| 13C2_PFDoA | | 54 | 50-150 |
| 13C2_PFTeDA | N | 49 | 50-150 |
| 13C3_PFBS | | 83 | 50-150 |
| 13C3_PFHxS | | 84 | 50-150 |
| 13C4_PFBA | | 84 | 50-150 |
| 13C4_PFHpA | | 79 | 50-150 |
| 13C5_PFHxA | | 83 | 50-150 |
| 13C5_PFPeA | | 84 | 50-150 |
| 13C6_PFDA | | 72 | 50-150 |
| 13C7_PFUdA | | 66 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 |
| 13C8_PFOS | | 70 | 50-150 |
| 13C8_PFOSA | | 81 | 50-150 |
| 13C9_PFNA | | 85 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WI18006-003**
Description: **VAP-VRTB-03_27.5-31.5**
Matrix: **Aqueous**
Date Sampled: **09/16/2021 1355**
Date Received: **09/18/2021**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 69 | 50-150 |
| d-MeFOSA | | 62 | 50-150 |
| d3-MeFOSAA | | 74 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18006-004**

Description: **VAP-VRTB-03_23-27** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1455**

Date Received: **09/18/2021**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 10/14/2021 1904 | JJG | 10/12/2021 1201 | 18442 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 33 | U | 66 | 33 | 17 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 33 | U | 66 | 33 | 17 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 33 | U | 66 | 33 | 17 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 33 | U | 66 | 33 | 17 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 65 | U | 130 | 65 | 33 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 33 | U | 66 | 33 | 17 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.3 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.3 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.3 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.3 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.3 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **10** | **J** | **33** | 17 | **8.3** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **160** | | **33** | 17 | **8.3** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **19** | **J** | **33** | 17 | **8.3** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.3 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.3 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **18** | **J** | **33** | 17 | **8.3** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **31** | **J** | **33** | 17 | **8.3** | **ng/L** | **1** |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.3 | ng/L | 1 |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **24** | **J** | **33** | 17 | **8.3** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **29** | **J** | **33** | 17 | **8.3** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.3 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.3 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 17 | U | 33 | 17 | 8.3 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **1200** | | **33** | 17 | **8.3** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 99 | 50-150 |
| 13C2_6:2FTS | | 98 | 50-150 |
| 13C2_8:2FTS | | 90 | 50-150 |
| 13C2_PFDoA | | 89 | 50-150 |
| 13C2_PFTeDA | | 97 | 50-150 |
| 13C3_PFBS | | 106 | 50-150 |
| 13C3_PFHxS | | 108 | 50-150 |
| 13C4_PFBA | | 99 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 95 | 50-150 |
| 13C7_PFUdA | | 90 | 50-150 |
| 13C8_PFOA | | 101 | 50-150 |
| 13C8_PFOS | | 94 | 50-150 |
| 13C8_PFOSA | | 110 | 50-150 |
| 13C9_PFNA | | 103 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WI18006-004**
Description: **VAP-VRTB-03_23-27**
Matrix: **Aqueous**
Date Sampled: **09/16/2021 1455**
Date Received: **09/18/2021**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 111 | 50-150 |
| d-MeFOSA | | 111 | 50-150 |
| d3-MeFOSAA | | 108 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18006-005**

Description: **VAP-VRTB-03_19-23** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1540**

Date Received: **09/18/2021**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 10/14/2021 1914 | JJG | 10/12/2021 1201 | 18442 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 700 | U | 1400 | 700 | 340 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **1400** | | **340** | 170 | **86** | **ng/L** | **1** |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **91** | **J** | **340** | 170 | **86** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **190** | **J** | **340** | 170 | **86** | **ng/L** | **1** |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **160** | **J** | **340** | 170 | **86** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **100** | **J** | **340** | 170 | **86** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **18000** | | **340** | 170 | **86** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 |
| 13C2_6:2FTS | | 97 | 50-150 |
| 13C2_8:2FTS | | 94 | 50-150 |
| 13C2_PFDoA | | 86 | 50-150 |
| 13C2_PFTeDA | | 97 | 50-150 |
| 13C3_PFBS | | 101 | 50-150 |
| 13C3_PFHxS | | 103 | 50-150 |
| 13C4_PFBA | | 100 | 50-150 |
| 13C4_PFHpA | | 98 | 50-150 |
| 13C5_PFHxA | | 100 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 |
| 13C7_PFUdA | | 96 | 50-150 |
| 13C8_PFOA | | 96 | 50-150 |
| 13C8_PFOS | | 96 | 50-150 |
| 13C8_PFOSA | | 108 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WI18006-005**
Description: **VAP-VRTB-03_19-23**
Matrix: **Aqueous**
Date Sampled: **09/16/2021 1540**
Date Received: **09/18/2021**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 106 | 50-150 |
| d-MeFOSA | | 106 | 50-150 |
| d3-MeFOSAA | | 107 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18006-006**

Description: **VAP-VRTB-03_15-19** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1640**

Date Received: **09/18/2021**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/16/2021 1555 | MMM | 10/14/2021 1149 | 18749 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/22/2021 1417 | MMM | 10/14/2021 1149 | 18749 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| **1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)** | **39108-34-4** | **PFAS by ID SOP** | **2.1** | **J** | **6.9** | 3.5 | **1.7** | **ng/L** | **1** |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **2.4** | **J** | **6.9** | 3.5 | **1.7** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **73** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **4.9** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **3.5** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **90** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **21** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **59** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **40** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **7.2** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **53** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **47** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **760** | **B** | **17** | 8.5 | **4.3** | **ng/L** | **2** |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 147 | 50-150 | | 118 | 50-150 |
| 13C2_6:2FTS | | 117 | 50-150 | | 92 | 50-150 |
| 13C2_8:2FTS | | 91 | 50-150 | | 84 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 | | 82 | 50-150 |
| 13C2_PFTeDA | | 71 | 50-150 | | 86 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 | | 93 | 50-150 |
| 13C3_PFHxS | | 103 | 50-150 | | 93 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 | | 91 | 50-150 |
| 13C4_PFHpA | | 82 | 50-150 | | 94 | 50-150 |
| 13C5_PFHxA | | 89 | 50-150 | | 94 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 | | 84 | 50-150 |
| 13C6_PFDA | | 97 | 50-150 | | 88 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 | | 91 | 50-150 |
| 13C8_PFOA | | 98 | 50-150 | | 89 | 50-150 |
| 13C8_PFOS | | 83 | 50-150 | | 85 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 | | 88 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WI18006-006**
Description: **VAP-VRTB-03_15-19**
Matrix: **Aqueous**
Date Sampled: **09/16/2021 1640**
Date Received: **09/18/2021**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 91 | 50-150 | | 87 | 50-150 |
| d5-EtFOSAA | | 88 | 50-150 | | 94 | 50-150 |
| d-MeFOSA | | 81 | 50-150 | | 83 | 50-150 |
| d3-MeFOSAA | | 101 | 50-150 | | 83 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18442-001
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/14/2021 1451 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/14/2021 1451 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/14/2021 1451 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/14/2021 1451 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/14/2021 1451 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/14/2021 1451 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 106 | 50-150 |
| 13C2_6:2FTS | | 98 | 50-150 |
| 13C2_8:2FTS | | 87 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 80 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 |
| 13C4_PFHpA | | 94 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 89 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18442-001
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 |
| 13C9_PFNA | | 97 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 |
| d-MeFOSA | | 78 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18442-002
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 18 | | 1 | 117 | 67-138 | 10/14/2021 1502 |
| 6:2 FTS | 15 | 15 | | 1 | 96 | 64-140 | 10/14/2021 1502 |
| 4:2 FTS | 15 | 13 | | 1 | 87 | 63-143 | 10/14/2021 1502 |
| EtFOSAA | 16 | 17 | | 1 | 105 | 61-135 | 10/14/2021 1502 |
| MeFOSA | 16 | 15 | | 1 | 94 | 68-141 | 10/14/2021 1502 |
| MeFOSAA | 16 | 16 | | 1 | 99 | 65-136 | 10/14/2021 1502 |
| PFBS | 14 | 14 | | 1 | 99 | 72-130 | 10/14/2021 1502 |
| PFDS | 15 | 13 | | 1 | 87 | 53-142 | 10/14/2021 1502 |
| PFHpS | 15 | 14 | | 1 | 93 | 69-134 | 10/14/2021 1502 |
| PFNS | 15 | 15 | | 1 | 95 | 69-127 | 10/14/2021 1502 |
| PFOSA | 16 | 14 | | 1 | 89 | 67-137 | 10/14/2021 1502 |
| PFPeS | 15 | 14 | | 1 | 91 | 71-127 | 10/14/2021 1502 |
| PFHxS | 15 | 14 | | 1 | 94 | 68-131 | 10/14/2021 1502 |
| PFBA | 16 | 15 | | 1 | 96 | 73-129 | 10/14/2021 1502 |
| PFDA | 16 | 16 | | 1 | 100 | 71-129 | 10/14/2021 1502 |
| PFDoA | 16 | 15 | | 1 | 96 | 72-134 | 10/14/2021 1502 |
| PFHpA | 16 | 16 | | 1 | 101 | 72-130 | 10/14/2021 1502 |
| PFHxA | 16 | 15 | | 1 | 95 | 72-129 | 10/14/2021 1502 |
| PFNA | 16 | 15 | | 1 | 96 | 69-130 | 10/14/2021 1502 |
| PFOA | 16 | 15 | | 1 | 96 | 71-133 | 10/14/2021 1502 |
| PFPeA | 16 | 16 | | 1 | 98 | 72-129 | 10/14/2021 1502 |
| PFTeDA | 16 | 16 | | 1 | 101 | 71-132 | 10/14/2021 1502 |
| PFTrDA | 16 | 15 | | 1 | 96 | 65-144 | 10/14/2021 1502 |
| PFUdA | 16 | 18 | | 1 | 111 | 69-133 | 10/14/2021 1502 |
| PFOS | 15 | 14 | | 1 | 97 | 65-140 | 10/14/2021 1502 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 101 | 50-150 |
| 13C2_6:2FTS | | 90 | 50-150 |
| 13C2_8:2FTS | | 80 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 |
| 13C4_PFBA | | 90 | 50-150 |
| 13C4_PFHpA | | 86 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 |
| 13C6_PFDA | | 86 | 50-150 |
| 13C7_PFUdA | | 75 | 50-150 |
| 13C8_PFOA | | 89 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18442-002
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 85 | 50-150 |
| 13C9_PFNA | | 90 | 50-150 |
| d5-EtFOSAA | | 86 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18749-001
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/15/2021 1309 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/15/2021 1309 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/15/2021 1309 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/15/2021 1309 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/15/2021 1309 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/15/2021 1309 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| **PFOS** | **1.5** | **J** | **1** | **4.0** | 2.0 | **1.0** | **ng/L** | **10/15/2021 1309** |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 91 | 50-150 |
| 13C2_6:2FTS | | 94 | 50-150 |
| 13C2_8:2FTS | | 82 | 50-150 |
| 13C2_PFDoA | | 85 | 50-150 |
| 13C2_PFTeDA | | 87 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 |
| 13C3_PFHxS | | 87 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 |
| 13C5_PFPeA | | 91 | 50-150 |
| 13C6_PFDA | | 86 | 50-150 |
| 13C7_PFUdA | | 100 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18749-001
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 86 | 50-150 |
| 13C8_PFOSA | | 91 | 50-150 |
| 13C9_PFNA | | 101 | 50-150 |
| d5-EtFOSAA | | 87 | 50-150 |
| d-MeFOSA | | 67 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18749-002
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 15 | | 1 | 99 | 67-138 | 10/15/2021 1320 |
| 6:2 FTS | 15 | 16 | | 1 | 102 | 64-140 | 10/15/2021 1320 |
| 4:2 FTS | 15 | 15 | | 1 | 100 | 63-143 | 10/15/2021 1320 |
| EtFOSAA | 16 | 15 | | 1 | 96 | 61-135 | 10/15/2021 1320 |
| MeFOSA | 16 | 18 | | 1 | 113 | 68-141 | 10/15/2021 1320 |
| MeFOSAA | 16 | 16 | | 1 | 101 | 65-136 | 10/15/2021 1320 |
| PFBS | 14 | 13 | | 1 | 94 | 72-130 | 10/15/2021 1320 |
| PFDS | 15 | 14 | | 1 | 91 | 53-142 | 10/15/2021 1320 |
| PFHpS | 15 | 15 | | 1 | 97 | 69-134 | 10/15/2021 1320 |
| PFNS | 15 | 15 | | 1 | 95 | 69-127 | 10/15/2021 1320 |
| PFOSA | 16 | 13 | | 1 | 84 | 67-137 | 10/15/2021 1320 |
| PFPeS | 15 | 15 | | 1 | 98 | 71-127 | 10/15/2021 1320 |
| PFHxS | 15 | 14 | | 1 | 94 | 68-131 | 10/15/2021 1320 |
| PFBA | 16 | 15 | | 1 | 96 | 73-129 | 10/15/2021 1320 |
| PFDA | 16 | 16 | | 1 | 97 | 71-129 | 10/15/2021 1320 |
| PFDoA | 16 | 16 | | 1 | 101 | 72-134 | 10/15/2021 1320 |
| PFHpA | 16 | 16 | | 1 | 100 | 72-130 | 10/15/2021 1320 |
| PFHxA | 16 | 15 | | 1 | 92 | 72-129 | 10/15/2021 1320 |
| PFNA | 16 | 16 | | 1 | 103 | 69-130 | 10/15/2021 1320 |
| PFOA | 16 | 15 | | 1 | 95 | 71-133 | 10/15/2021 1320 |
| PFPeA | 16 | 16 | | 1 | 100 | 72-129 | 10/15/2021 1320 |
| PFTeDA | 16 | 17 | | 1 | 103 | 71-132 | 10/15/2021 1320 |
| PFTrDA | 16 | 15 | | 1 | 95 | 65-144 | 10/15/2021 1320 |
| PFUdA | 16 | 16 | | 1 | 103 | 69-133 | 10/15/2021 1320 |
| PFOS | 15 | 13 | | 1 | 89 | 65-140 | 10/15/2021 1320 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 89 | 50-150 |
| 13C2_6:2FTS | | 95 | 50-150 |
| 13C2_8:2FTS | | 78 | 50-150 |
| 13C2_PFDoA | | 81 | 50-150 |
| 13C2_PFTeDA | | 86 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 |
| 13C5_PFHxA | | 92 | 50-150 |
| 13C5_PFPeA | | 87 | 50-150 |
| 13C6_PFDA | | 85 | 50-150 |
| 13C7_PFUdA | | 95 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18749-002
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 85 | 50-150 |
| 13C8_PFOSA | | 90 | 50-150 |
| 13C9_PFNA | | 95 | 50-150 |
| d5-EtFOSAA | | 81 | 50-150 |
| d-MeFOSA | | 56 | 50-150 |
| d3-MeFOSAA | | 85 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# Chain of Custody
# and
# Miscellaneous Documents

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 125876

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Patrick Curry | Telephone No. / E-mail: 231-536-5092 kristen.hasbrouck@arcadis.com; 734-355-2804 patrick.curry@arcadis.com | Quote No. |
| Address: 2855-0 Cabot Dr #E00 | Sampler's Signature: X | Analysis (Attach list if more space is needed) | Page 1 of |
| City: Novi | State: MI | Zip Code: 48377 | Printed Name: Madison Olender |
| Project Name: ESTEE GAAF Vertebrae | | | |
| Project No.: 30027244 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Collected (Composite) | Matrix: Aq. Solid Wipe | No. of Containers by Preservative Type: Unpres. HNO3 H2SO4 NaOH Na2S2O3 Methanol | PFAS - method 537.1 with isotope dilution (Arcadis SOP) | true - TOF |
|---|---|---|---|---|---|---|---|
| VAP-VRTB-03_36-40 | 9/16/2021 | 1050 | G | X | 4 | X | X |
| VAP-VRTB-03_32-36 | | 1255 | | | | | |
| VAP-VRTB-03_27.5-31.5 | | 1355 | | | | | |
| VAP-VRTB-03_23-27 | | 1455 | | | | | |
| VAP-VRTB-03_19-23 | | 1540 | | | | | |
| VAP-VRTB-03_15-19 | | 1640 | | | | | |
| temp blank | | | | | | | |

WI18006
RES2
Remarks / Cooler I.D.

Turn Around Time Required (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by | 9/17/21 | 1030 | 1. Received by | | |
| 2. Relinquished by | | | 2. Received by | | |
| 3. Relinquished by | | | 3. Received by | | |
| 4. Relinquished by: Fedex | 9/18/21 | 0930 | 4. Laboratory received by: Tanya Stenbaum | 9/18/21 | 0930 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on Ice (Circle): (Yes) No Ice Pack — Receipt Temp: 3.5 °C — Temp Blank: Y / N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME043N2-01

PACE ANALYTICAL SERVICES, LLC

PaceAnalytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised: 8/29/2020


# Sample Receipt Checklist (SRC)

Client: ARCADIS  Cooler inspected by/date: JRG2 / 09/18/2021  Lot #: WI18006

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No | ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: NA

3.5 / 3.5 °C  NA / NA °C  NA / NA °C  NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles  IR Gun ID: 5  IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☐ Yes | ☐ No | ☑ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☐ Yes | ☑ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc...) correctly transcribed from the COC into the comment section in LIMS? |
| ☐ Yes | ☑ No | | 21. Was the quote number listed on the container label? If yes, Quote # NA |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: $H_2SO_4$, $HNO_3$, HCl, NaOH using SR # NA.

Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2  Date: 09/18/2021

Comments:

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

November 02, 2021

Kathy Smith
Pace South Carolina
106 Vantage Point Drive
West Columbia, SC 29172

RE: Project: WI18006 Arcadis
Pace Project No.: 10580325

Dear Kathy Smith:

Enclosed are the analytical results for sample(s) received by the laboratory on September 24, 2021. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Minneapolis

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Ashley Williams
ashley.williams@pacelabs.com
(612)607-1700
Project Manager

Enclosures

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## CERTIFICATIONS

Project: WI18006 Arcadis
Pace Project No.: 10580325

**Pace Analytical Services, LLC - Minneapolis MN**

1700 Elm Street SE, Minneapolis, MN 55414
1800 Elm Street SE, Minneapolis, MN 55414--Satellite Air Lab
A2LA Certification #: 2926.01*
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: 17-009*
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014*
Arkansas DW Certification #: MN00064
Arkansas WW Certification #: 88-0680
California Certification #: 2929
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
EPA Region 8 Tribal Water Systems+Wyoming DW Certification #: via MN 027-053-137
Florida Certification #: E87605*
Georgia Certification #: 959
Hawaii Certification #: MN00064
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: AI-03086*
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064*
Maryland Certification #: 322
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137*
Minnesota Dept of Ag Approval: via MN 027-053-137
Minnesota Petrofund Registration #: 1240*
Mississippi Certification #: MN00064
Missouri Certification #: 10100
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081*
New Jersey Certification #: MN002
New York Certification #: 11647*
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification (1700) #: CL101
Ohio VAP Certification (1800) #: CL110*
Oklahoma Certification #: 9507*
Oregon Primary Certification #: MN300001
Oregon Secondary Certification #: MN200001*
Pennsylvania Certification #: 68-00563*
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192*
Utah Certification #: MN00064*
Vermont Certification #: VT-027053137
Virginia Certification #: 460163*
Washington Certification #: C486*
West Virginia DEP Certification #: 382
West Virginia DW Certification #: 9952 C
Wisconsin Certification #: 999407970
Wyoming UST Certification #: via A2LA 2926.01
USDA Permit #: P330-19-00208
*Please Note: Applicable air certifications are denoted with an asterisk (*).



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## SAMPLE SUMMARY

Project: WI18006 Arcadis
Pace Project No.: 10580325

| Lab ID | Sample ID | Matrix | Date Collected | Date Received |
|---|---|---|---|---|
| **10580325001** | **VAP-VRTB-03_36-40** | Water | 09/16/21 10:50 | 09/24/21 11:40 |
| **10580325002** | **VAP-VRTB-03_32-36** | Water | 09/16/21 12:55 | 09/24/21 11:40 |
| **10580325003** | **VAP-VRTB-03_27.5-31.5** | Water | 09/16/21 13:55 | 09/24/21 11:40 |
| **10580325004** | **VAP-VRTB-03_23-27** | Water | 09/16/21 14:55 | 09/24/21 11:40 |
| **10580325005** | **VAP-VRTB-03_19-23** | Water | 09/16/21 15:40 | 09/24/21 11:40 |
| **10580325006** | **VAP-VRTB-03_15-19** | Water | 09/16/21 16:40 | 09/24/21 11:40 |



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## SAMPLE ANALYTE COUNT

Project: WI18006 Arcadis
Pace Project No.: 10580325

| Lab ID | Sample ID | Method | Analysts | Analytes Reported |
|---|---|---|---|---|
| **10580325001** | **VAP-VRTB-03_36-40** | True TOF | AR3 | 3 |
| **10580325002** | **VAP-VRTB-03_32-36** | True TOF | AR3 | 3 |
| **10580325003** | **VAP-VRTB-03_27.5-31.5** | True TOF | AR3 | 3 |
| **10580325004** | **VAP-VRTB-03_23-27** | True TOF | AR3 | 3 |
| **10580325005** | **VAP-VRTB-03_19-23** | True TOF | AR3 | 3 |
| **10580325006** | **VAP-VRTB-03_15-19** | True TOF | AR3 | 3 |

PASI-M = Pace Analytical Services - Minneapolis



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

# PROJECT NARRATIVE

Project: WI18006 Arcadis
Pace Project No.: 10580325

**Method:** **True TOF**
**Description:** Total Organofluorine
**Client:** Pace West Columbia,SC
**Date:** November 02, 2021

**General Information:**
6 samples were analyzed for True TOF by Pace Analytical Services Minneapolis. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

**Hold Time:**
The samples were analyzed within the method required hold times with any exceptions noted below.

H1: Analysis conducted outside the recognized method holding time.
- VAP-VRTB-03_36-40 (Lab ID: 10580325001)

H5: Reanalysis conducted in excess of EPA method holding time. Results confirm original analysis performed in hold time.
- VAP-VRTB-03_15-19 (Lab ID: 10580325006)
- VAP-VRTB-03_19-23 (Lab ID: 10580325005)
- VAP-VRTB-03_23-27 (Lab ID: 10580325004)
- VAP-VRTB-03_27.5-31.5 (Lab ID: 10580325003)
- VAP-VRTB-03_32-36 (Lab ID: 10580325002)

**Method Blank:**
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

**Laboratory Control Spike:**
All laboratory control spike compounds were within QC limits with any exceptions noted below.

**Matrix Spikes:**
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

QC Batch: 778366

A matrix spike and/or matrix spike duplicate (MS/MSD) were performed on the following sample(s): 10583596001

M3: Matrix spike recovery was outside laboratory control limits due to matrix interferences.
- MSD (Lab ID: 4145516)
  - Total Organofluorine

R2: RPD value was outside control limits due to matrix interference
- MSD (Lab ID: 4145516)
  - Total Organofluorine

**Additional Comments:**

Analyte Comments:

QC Batch: 778366

N2: The lab does not hold NELAC/TNI accreditation for this parameter but other accreditations/certifications may apply. A complete list of accreditations/certifications is available upon request.
- BLANK (Lab ID: 4145513)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## PROJECT NARRATIVE

Project: WI18006 Arcadis
Pace Project No.: 10580325

**Method:** **True TOF**
**Description:** Total Organofluorine
**Client:** Pace West Columbia,SC
**Date:** November 02, 2021

Analyte Comments:

QC Batch: 778366

N2: The lab does not hold NELAC/TNI accreditation for this parameter but other accreditations/certifications may apply. A complete list of accreditations/certifications is available upon request.

- LCS (Lab ID: 4145514)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- MS (Lab ID: 4145515)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- MSD (Lab ID: 4145516)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- VAP-VRTB-03_15-19 (Lab ID: 10580325006)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- VAP-VRTB-03_19-23 (Lab ID: 10580325005)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- VAP-VRTB-03_23-27 (Lab ID: 10580325004)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- VAP-VRTB-03_27.5-31.5 (Lab ID: 10580325003)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- VAP-VRTB-03_32-36 (Lab ID: 10580325002)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- VAP-VRTB-03_36-40 (Lab ID: 10580325001)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine

This data package has been reviewed for quality and completeness and is approved for release.



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## ANALYTICAL RESULTS

Project: WI18006 Arcadis
Pace Project No.: 10580325

**Sample: VAP-VRTB-03_36-40** **Lab ID: 10580325001** Collected: 09/16/21 10:50 Received: 09/24/21 11:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | |
| Free Fluoride | ND | mg/L | 0.050 | 1 | | 10/28/21 22:01 | | H1,N2 |
| Total Fluorine | ND | mg/L | 0.10 | 1 | | 10/28/21 22:01 | | H1,N2 |
| Total Organofluorine | ND | mg/L | 0.050 | 1 | | 10/28/21 22:01 | | H1,N2 |

**Sample: VAP-VRTB-03_32-36** **Lab ID: 10580325002** Collected: 09/16/21 12:55 Received: 09/24/21 11:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | |
| Free Fluoride | ND | mg/L | 0.050 | 1 | | 10/28/21 22:46 | | H5,N2 |
| Total Fluorine | ND | mg/L | 0.10 | 1 | | 10/28/21 22:46 | | H5,N2 |
| Total Organofluorine | ND | mg/L | 0.050 | 1 | | 10/28/21 22:46 | | H5,N2 |

**Sample: VAP-VRTB-03_27.5-31.5** **Lab ID: 10580325003** Collected: 09/16/21 13:55 Received: 09/24/21 11:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | |
| Free Fluoride | ND | mg/L | 0.050 | 1 | | 10/28/21 23:30 | | H5,N2 |
| Total Fluorine | ND | mg/L | 0.10 | 1 | | 10/28/21 23:30 | | H5,N2 |
| Total Organofluorine | ND | mg/L | 0.050 | 1 | | 10/28/21 23:30 | | H5,N2 |

**Sample: VAP-VRTB-03_23-27** **Lab ID: 10580325004** Collected: 09/16/21 14:55 Received: 09/24/21 11:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | |
| Free Fluoride | ND | mg/L | 0.050 | 1 | | 10/29/21 00:15 | | H5,N2 |
| Total Fluorine | ND | mg/L | 0.10 | 1 | | 10/29/21 00:15 | | H5,N2 |
| Total Organofluorine | ND | mg/L | 0.050 | 1 | | 10/29/21 00:15 | | H5,N2 |

**Sample: VAP-VRTB-03_19-23** **Lab ID: 10580325005** Collected: 09/16/21 15:40 Received: 09/24/21 11:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | |
| Free Fluoride | ND | mg/L | 0.050 | 1 | | 10/29/21 01:00 | | H5,N2 |

## REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## ANALYTICAL RESULTS

Project: WI18006 Arcadis
Pace Project No.: 10580325

**Sample: VAP-VRTB-03_19-23** **Lab ID: 10580325005** Collected: 09/16/21 15:40 Received: 09/24/21 11:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF | | | | | | | |
| | Pace Analytical Services - Minneapolis | | | | | | | |
| Total Fluorine | ND | mg/L | 0.10 | 1 | | 10/29/21 01:00 | | H5,N2 |
| Total Organofluorine | ND | mg/L | 0.050 | 1 | | 10/29/21 01:00 | | H5,N2 |

**Sample: VAP-VRTB-03_15-19** **Lab ID: 10580325006** Collected: 09/16/21 16:40 Received: 09/24/21 11:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF | | | | | | | |
| | Pace Analytical Services - Minneapolis | | | | | | | |
| Free Fluoride | ND | mg/L | 0.050 | 1 | | 10/29/21 01:45 | | H5,N2 |
| Total Fluorine | ND | mg/L | 0.10 | 1 | | 10/29/21 01:45 | | H5,N2 |
| Total Organofluorine | ND | mg/L | 0.050 | 1 | | 10/29/21 01:45 | | H5,N2 |



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## QUALITY CONTROL DATA

Project: WI18006 Arcadis
Pace Project No.: 10580325

QC Batch: 778366
QC Batch Method: True TOF
Analysis Method: True TOF
Analysis Description: Total Organofluorine
Laboratory: Pace Analytical Services - Minneapolis
Associated Lab Samples: 10580325001, 10580325002, 10580325003, 10580325004, 10580325005, 10580325006

METHOD BLANK: 4145513 Matrix: Water
Associated Lab Samples: 10580325001, 10580325002, 10580325003, 10580325004, 10580325005, 10580325006

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Free Fluoride | mg/L | ND | 0.050 | 10/28/21 19:22 | N2 |
| Total Fluorine | mg/L | ND | 0.10 | 10/28/21 19:22 | N2 |
| Total Organofluorine | mg/L | 0.050 | 0.050 | 10/28/21 19:22 | N2 |

LABORATORY CONTROL SAMPLE: 4145514

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Free Fluoride | mg/L | 1 | 0.97 | 97 | 75-125 | N2 |
| Total Fluorine | mg/L | 2 | 2.0 | 102 | 75-125 | N2 |
| Total Organofluorine | mg/L | 1 | 1.1 | 106 | 75-125 | N2 |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 4145515 4145516

| Parameter | Units | 10583596001 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Free Fluoride | mg/L | ND | 1 | 1 | 0.92 | 0.99 | 90 | 97 | 50-150 | 7 | 20 | N2 |
| Total Fluorine | mg/L | ND | 2 | 2 | 1.5 | 1.4 | 74 | 65 | 50-150 | 13 | 20 | N2 |
| Total Organofluorine | mg/L | ND | 1 | 1 | 0.63 | 0.37 | 59 | 33 | 50-150 | 52 | 20 | M3,N2, R2 |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**

## REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

# QUALIFIERS

Project: WI18006 Arcadis
Pace Project No.: 10580325

## DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

## ANALYTE QUALIFIERS

| | |
|---|---|
| H1 | Analysis conducted outside the recognized method holding time. |
| H5 | Reanalysis conducted in excess of EPA method holding time. Results confirm original analysis performed in hold time. |
| M3 | Matrix spike recovery was outside laboratory control limits due to matrix interferences. |
| N2 | The lab does not hold NELAC/TNI accreditation for this parameter but other accreditations/certifications may apply. A complete list of accreditations/certifications is available upon request. |
| R2 | RPD value was outside control limits due to matrix interference |



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: WI18006 Arcadis
Pace Project No.: 10580325

| Lab ID | Sample ID | QC Batch Method | QC Batch | Analytical Method | Analytical Batch |
|---|---|---|---|---|---|
| **10580325001** | **VAP-VRTB-03_36-40** | True TOF | 778366 | | |
| **10580325002** | **VAP-VRTB-03_32-36** | True TOF | 778366 | | |
| **10580325003** | **VAP-VRTB-03_27.5-31.5** | True TOF | 778366 | | |
| **10580325004** | **VAP-VRTB-03_23-27** | True TOF | 778366 | | |
| **10580325005** | **VAP-VRTB-03_19-23** | True TOF | 778366 | | |
| **10580325006** | **VAP-VRTB-03_15-19** | True TOF | 778366 | | |



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

Chain of Custody

Pace Analytical
www.pacelabs.com

Workorder: WI18006 Workorder Name: ESTCP GAAF Vertebrae Owner Received Date: 9/20/2021 Results Requested By: 10/1/2021

| Report To: | Subcontract To: |
|---|---|
| Kathy Smith | |
| Pace Analytical | |
| 106 Vantage Point Drive | Pace |
| Columbia SC, 29223 | 1700 Elm St. SE |
| 803-227-2704 | Minneapolis, MN 55414 |
| kathy.smith@pacelabs.com | |

| Item | Sample ID | Sample Type | Collect Date/Time | Lab ID | Matrix | Preserved Containers: NON | Requested Analysis: True - TOF | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | VAP-VRTB-03_36-40 | | 9/16/2021 1050 | | water | X | X | 001 |
| 3 | VAP-VRTB-03_32-36 | | 9/16/2021 1255 | | water | X | X | 002 |
| 4 | VAP-VRTB-03_27.5-31.5 | | 9/16/2021 1355 | | water | X | X | 003 |
| 5 | VAP-VRTB-03_23-27 | | 9/16/2021 1455 | | water | X | X | 004 |
| 6 | VAP-VRTB-03_19-23 | | 9/16/2021 1540 | | water | X | X | 005 |
| 7 | VAP-VRTB-03_15-19 | | 9/16/2021 1640 | | water | X | X | 006 |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |

| Transfers | Released By | Date/Time | Reveived By | Date/Time | Comments |
|---|---|---|---|---|---|
| 1 | [signature] | 9/21/21 1920 | [signature] | 9/23/21 1040 | |
| 2 | | | | | |
| 3 | | | | | |

Cooler Temperature on Receipt 0.1 °C | Custody Seal Y or N | Received on Ice Y or N | Sample Intact Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document. This chain of custody is considered complete as is since this information is available in the owner laboratory.



WO# : 10580325

10580325

| Pace Analytical® | Document Name: **Sample Condition Upon Receipt (SCUR) - MN** | Document Revised: 14Apr2021 **Page 1 of 1** |
|---|---|---|
| | Document No.: **ENV-FRM-MIN4-0150 Rev.02** | Pace Analytical Services - **Minneapolis** |

**Sample Condition Upon Receipt**

**Client Name:** Pace SC

**Project #:** WO#: 10580325
PM: AW1 Due Date: 10/15/21
CLIENT: Shealy Env

**Courier:** ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Pace ☐ SpeeDee ☐ Commercial

**Tracking Number:** 1663 3465 8998 — See Exceptions ☐ ENV-FRM-MIN4-0142

**Custody Seal on Cooler/Box Present?** ☒ Yes ☐ No **Seals Intact?** ☒ Yes ☐ No **Biological Tissue Frozen?** ☐ Yes ☐ No ☒ N/A

**Packing Material:** ☐ Bubble Wrap ☐ Bubble Bags ☒ None ☐ Other:_____ **Temp Blank?** ☒ Yes ☐ No

**Thermometer:** ☐ T1(0461) ☐ T2(1336) ☐ T3(0459) ☐ OS418-LS ☒ T4(0254) ☐ T5(0489) ☐ 160285052 **Type of Ice:** ☐ Wet ☐ Blue ☐ None ☐ Dry ☐ Melted

**Did Samples Originate in West Virginia?** ☐ Yes ☒ No **Were All Container Temps Taken?** ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C **Cooler Temp Read w/temp blank:** 0.1 °C **Average Corrected Temp (no temp blank only):** _____ °C ☐ See Exceptions ENV-FRM-MIN4-0142 ☐ 1 Container

**Correction Factor:** true **Cooler Temp Corrected w/temp blank:** 0.1 °C

**USDA Regulated Soil:** ( ☒ N/A, water sample/Other:_____)
Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA. MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☐ No

**Date/Initials of Person Examining Contents:** RHL 9.24.21
Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

**If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.**

| | | | | COMMENTS: |
|---|---|---|---|---|
| Chain of Custody Present and Filled Out? | ☒ Yes | ☐ No | | 1. |
| Chain of Custody Relinquished? | ☒ Yes | ☐ No | | 2. |
| Sampler Name and/or Signature on COC? | ☐ Yes | ☐ No | ☒ N/A | 3. |
| Samples Arrived within Hold Time? | ☒ Yes | ☐ No | | 4. |
| **Short Hold Time Analysis (<72 hr)?** | ☐ Yes | ☒ No | | 5. ☐ Fecal Coliform ☐ HPC ☐ Total Coliform/E coli ☐ BOD/cBOD ☐ Hex Chrome ☐ Turbidity ☐ Nitrate ☐ Nitrite ☐ Orthophos ☐ Other_____ |
| **Rush Turn Around Time Requested?** | ☐ Yes | ☒ No | | 6. |
| Sufficient Volume? | ☒ Yes | ☐ No | | 7. |
| Correct Containers Used? -Pace Containers Used? | ☒ Yes ☒ Yes | ☐ No ☐ No | | 8. |
| Containers Intact? | ☒ Yes | ☐ No | | 9. |
| Field Filtered Volume Received for Dissolved Tests? | ☐ Yes | ☐ No | ☒ N/A | 10. Is sediment visible in the dissolved container? ☐ Yes ☐ No |
| Is sufficient information available to reconcile the samples to the COC? Matrix: ☒ Water ☐ Soil ☐ Oil ☐ Other_____ | ☒ Yes | ☐ No | | 11. **If no, write ID/ Date/Time on Container Below:** **See Exception** ☐ **ENV-FRM-MIN4-0142** |
| All containers needing acid/base preservation have been checked? | ☐ Yes | ☐ No | ☒ N/A | 12. Sample # |
| All containers needing preservation are found to be in compliance with EPA recommendation? ($HNO_3$, $H_2SO_4$, <2pH, NaOH >9 Sulfide, NaOH>10 Cyanide) | ☐ Yes | ☐ No | ☒ N/A | ☐ NaOH ☐ $HNO_3$ ☐ $H_2SO_4$ ☐ Zinc Acetate |
| Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin/PFAS | ☐ Yes | ☐ No | ☒ N/A | Positive for Res. Chlorine? ☐ Yes ☐ No **pH Paper Lot#** **See Exception** ☐ **ENV-FRM-MIN4-0142** |
| | | | | Res. Chlorine \| 0-6 Roll \| 0-6 Strip \| 0-14 Strip |
| Extra labels present on soil VOA or WIDRO containers? | ☐ Yes | ☐ No | ☒ N/A | 13. **See Exception** ☐ **ENV-FRM-MIN4-0140** |
| Headspace in VOA Vials (greater than 6mm)? | ☐ Yes | ☐ No | ☒ N/A | |
| Trip Blank Present? | ☐ Yes | ☐ No | ☒ N/A | 14. |
| Trip Blank Custody Seals Present? | ☐ Yes | ☐ No | ☒ N/A | Pace Trip Blank Lot # (if purchased):_____ |

**CLIENT NOTIFICATION/RESOLUTION** **Field Data Required?** ☐ Yes ☐ No

Person Contacted:_____ Date/Time:_____

Comments/Resolution:_____

**Project Manager Review:** Ashley Williams **Date:** 9/24/21

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

Labeled by: RHL 9

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP Vertebrae

Project Number: 30027244

Lot Number:**WI18007**

Date Completed:10/27/2021

10/28/2021 1:44 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: WI18007

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

For samples WI18007-001 and WI18007-012, sample matrix prevented full volume from being extracted, precluding method mandated bottle rinse. Elution solvent was aliquoted directly into the reservoir, rinsing the inside. Surrogate recovery may be adversely affected.

Samples WI18007-001, WI18007-002, WI18007-003, WI18007-009, WI18007-010, WI18007-011, and WI18007-013 required centrifugation prior to extraction, due to excessive solids present in the samples. Centrifugation was performed following the PFAS Aqueous Centrifuge Protocol; samples were spiked with Surrogate (SUR; Extracted Internal Standard/EIS) and shaken vigorously before being poured into 6 50mL tubes and centrifuged. The centrifuged aqueous sample was decanted back into the original sample bottle, off of the condensed solids remaining in the centrifuge tubes. Original sample bottle was rinsed as normal and centrifuge tubes were rinsed with 0.5mL of MeOH each (total of 3mL). Centrifuge bottle rinsate was added to the elution. Samples concentrated to <10mL and reconstituted to 10mL using MeOH by transfer pipet.

The continuing calibration verification (CCV) associated with sample(s) WI18006-001, WI18006-002, WI18006-003, WI18007-014, WI18007-015, WI18007-016 recovered above the upper control limit for the 4:2-FTS EIS compound. The sample(s) associated with this CCV were non-detect for the affected analyte; therefore, the data has been reported.

The laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for prep batch 18205 exceeded acceptance criteria for the 6:2-FTS EIS compound. 6-FTS was not detected in the follwing samples: WI18007-003, WI18007-004, WI18007-006. Other samples were re-extracted and re-analyzed outside of holding time, both sets of data have been reported.

Surrogate recovery for the following sample was outside the upper control limit: WI18007-003, WI18007-006, WI18007-014, WI18007-016. This sample did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

Surrogate recovery for the following sample(s) was outside control limits: WI18007-013. Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

The MS/MSD associated with sample WI18006-007 had multiple analytes recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

## Sample Summary
## Arcadis U.S., Inc.
### Lot Number: WI18007
### Project Name: ESTCP Vertebrae
### Project Number: 30027244

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | VAP-VRTB-02_36-40 | Aqueous | 09/13/2021 1345 | 09/18/2021 |
| 002 | VAP-VRTB-01_34.5-38.5 | Aqueous | 09/13/2021 1530 | 09/18/2021 |
| 003 | VAP-VRTB-01_29.5-33.5 | Aqueous | 09/13/2021 1615 | 09/18/2021 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | 09/13/2021 1645 | 09/18/2021 |
| 005 | VAP-VRTB-DUP-01 | Aqueous | 09/13/2021 | 09/18/2021 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | 09/13/2021 1715 | 09/18/2021 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | 09/13/2021 1750 | 09/18/2021 |
| 008 | VRTB-EB01-(091421) | Aqueous | 09/14/2021 0900 | 09/18/2021 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | 09/14/2021 1040 | 09/18/2021 |
| 010 | VAP-VRTB-05_31-35 | Aqueous | 09/14/2021 1120 | 09/18/2021 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | 09/14/2021 1155 | 09/18/2021 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | 09/14/2021 1225 | 09/18/2021 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | 09/14/2021 1245 | 09/18/2021 |
| 014 | VRTB-EB02-(091621) | Aqueous | 09/16/2021 1110 | 09/18/2021 |
| 015 | VRTB-EB03-(091621) | Aqueous | 09/16/2021 1215 | 09/18/2021 |
| 016 | VRTB-EB04-(091621) | Aqueous | 09/16/2021 1230 | 09/18/2021 |
| 017 | VRTB-WB01-(091621) | Aqueous | 09/16/2021 1400 | 09/18/2021 |

(17 samples)

## Detection Summary

## Arcadis U.S., Inc.

**Lot Number: WI18007**

**Project Name: ESTCP Vertebrae**

**Project Number: 30027244**

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | VAP-VRTB-02_36-40 | Aqueous | PFBS | PFAS by ID | 1.3 | J | ng/L | 10 |
| 001 | VAP-VRTB-02_36-40 | Aqueous | PFHxS | PFAS by ID | 19 | | ng/L | 10 |
| 001 | VAP-VRTB-02_36-40 | Aqueous | PFBA | PFAS by ID | 3.9 | J | ng/L | 10 |
| 001 | VAP-VRTB-02_36-40 | Aqueous | PFHpA | PFAS by ID | 1.4 | J | ng/L | 10 |
| 001 | VAP-VRTB-02_36-40 | Aqueous | PFHxA | PFAS by ID | 4.0 | | ng/L | 10 |
| 001 | VAP-VRTB-02_36-40 | Aqueous | PFOA | PFAS by ID | 2.9 | J | ng/L | 10 |
| 001 | VAP-VRTB-02_36-40 | Aqueous | PFPeA | PFAS by ID | 2.1 | J | ng/L | 10 |
| 001 | VAP-VRTB-02_36-40 | Aqueous | PFOS | PFAS by ID | 100 | | ng/L | 10 |
| 001 | VAP-VRTB-02_36-40 | Aqueous | 6:2 FTS | PFAS by ID | 2.2 | HJ | ng/L | 12 |
| 002 | VAP-VRTB-01_34.5-38.5 | Aqueous | PFBS | PFAS by ID | 1.1 | J | ng/L | 14 |
| 002 | VAP-VRTB-01_34.5-38.5 | Aqueous | PFHpS | PFAS by ID | 0.93 | J | ng/L | 14 |
| 002 | VAP-VRTB-01_34.5-38.5 | Aqueous | PFPeS | PFAS by ID | 1.2 | J | ng/L | 14 |
| 002 | VAP-VRTB-01_34.5-38.5 | Aqueous | PFHxS | PFAS by ID | 17 | | ng/L | 14 |
| 002 | VAP-VRTB-01_34.5-38.5 | Aqueous | PFBA | PFAS by ID | 2.5 | J | ng/L | 14 |
| 002 | VAP-VRTB-01_34.5-38.5 | Aqueous | PFHpA | PFAS by ID | 1.3 | J | ng/L | 14 |
| 002 | VAP-VRTB-01_34.5-38.5 | Aqueous | PFHxA | PFAS by ID | 2.8 | J | ng/L | 14 |
| 002 | VAP-VRTB-01_34.5-38.5 | Aqueous | PFOA | PFAS by ID | 2.4 | J | ng/L | 14 |
| 002 | VAP-VRTB-01_34.5-38.5 | Aqueous | PFPeA | PFAS by ID | 1.9 | J | ng/L | 14 |
| 002 | VAP-VRTB-01_34.5-38.5 | Aqueous | PFOS | PFAS by ID | 150 | | ng/L | 14 |
| 003 | VAP-VRTB-01_29.5-33.5 | Aqueous | PFHxS | PFAS by ID | 16 | | ng/L | 16 |
| 003 | VAP-VRTB-01_29.5-33.5 | Aqueous | PFBA | PFAS by ID | 2.2 | J | ng/L | 16 |
| 003 | VAP-VRTB-01_29.5-33.5 | Aqueous | PFHpA | PFAS by ID | 1.6 | J | ng/L | 16 |
| 003 | VAP-VRTB-01_29.5-33.5 | Aqueous | PFHxA | PFAS by ID | 2.5 | J | ng/L | 16 |
| 003 | VAP-VRTB-01_29.5-33.5 | Aqueous | PFOA | PFAS by ID | 2.3 | J | ng/L | 16 |
| 003 | VAP-VRTB-01_29.5-33.5 | Aqueous | PFPeA | PFAS by ID | 2.1 | J | ng/L | 16 |
| 003 | VAP-VRTB-01_29.5-33.5 | Aqueous | PFOS | PFAS by ID | 37 | | ng/L | 16 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | PFBS | PFAS by ID | 1.7 | J | ng/L | 18 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | PFHpS | PFAS by ID | 1.5 | J | ng/L | 18 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | PFPeS | PFAS by ID | 2.6 | J | ng/L | 18 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | PFHxS | PFAS by ID | 44 | | ng/L | 18 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | PFBA | PFAS by ID | 5.2 | | ng/L | 18 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | PFHpA | PFAS by ID | 6.8 | | ng/L | 18 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | PFHxA | PFAS by ID | 9.5 | | ng/L | 18 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | PFNA | PFAS by ID | 1.1 | J | ng/L | 18 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | PFOA | PFAS by ID | 11 | | ng/L | 18 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | PFPeA | PFAS by ID | 10 | | ng/L | 18 |
| 004 | VAP-VRTB-01_25-29 | Aqueous | PFOS | PFAS by ID | 58 | | ng/L | 18 |
| 005 | VAP-VRTB-DUP-01 | Aqueous | PFBS | PFAS by ID | 5.7 | | ng/L | 20 |
| 005 | VAP-VRTB-DUP-01 | Aqueous | PFHpS | PFAS by ID | 2.2 | J | ng/L | 20 |
| 005 | VAP-VRTB-DUP-01 | Aqueous | PFPeS | PFAS by ID | 8.0 | | ng/L | 20 |
| 005 | VAP-VRTB-DUP-01 | Aqueous | PFHxS | PFAS by ID | 77 | | ng/L | 20 |
| 005 | VAP-VRTB-DUP-01 | Aqueous | PFBA | PFAS by ID | 13 | | ng/L | 20 |
| 005 | VAP-VRTB-DUP-01 | Aqueous | PFHpA | PFAS by ID | 11 | | ng/L | 20 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 005 | VAP-VRTB-DUP-01 | Aqueous | PFHxA | PFAS by ID | 16 | | ng/L | 20 |
| 005 | VAP-VRTB-DUP-01 | Aqueous | PFNA | PFAS by ID | 1.1 | J | ng/L | 20 |
| 005 | VAP-VRTB-DUP-01 | Aqueous | PFOA | PFAS by ID | 15 | | ng/L | 20 |
| 005 | VAP-VRTB-DUP-01 | Aqueous | PFPeA | PFAS by ID | 17 | | ng/L | 20 |
| 005 | VAP-VRTB-DUP-01 | Aqueous | PFOS | PFAS by ID | 95 | | ng/L | 20 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | PFBS | PFAS by ID | 4.9 | | ng/L | 24 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | PFHpS | PFAS by ID | 2.2 | J | ng/L | 24 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | PFPeS | PFAS by ID | 6.9 | | ng/L | 24 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | PFHxS | PFAS by ID | 76 | | ng/L | 24 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | PFBA | PFAS by ID | 13 | | ng/L | 24 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | PFHpA | PFAS by ID | 11 | | ng/L | 24 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | PFHxA | PFAS by ID | 17 | | ng/L | 24 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | PFNA | PFAS by ID | 0.99 | J | ng/L | 24 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | PFOA | PFAS by ID | 15 | | ng/L | 24 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | PFPeA | PFAS by ID | 18 | | ng/L | 24 |
| 006 | VAP-VRTB-01_20-24 | Aqueous | PFOS | PFAS by ID | 94 | | ng/L | 24 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | 8:2 FTS | PFAS by ID | 50 | | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFBS | PFAS by ID | 7.3 | | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFHpS | PFAS by ID | 36 | | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFOSA | PFAS by ID | 1.8 | J | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFPeS | PFAS by ID | 15 | | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFHxS | PFAS by ID | 550 | S | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFBA | PFAS by ID | 23 | | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFHpA | PFAS by ID | 58 | | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFHxA | PFAS by ID | 64 | | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFNA | PFAS by ID | 42 | | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFOA | PFAS by ID | 95 | S | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFPeA | PFAS by ID | 42 | | ng/L | 26 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | PFOS | PFAS by ID | 7300 | | ng/L | 28 |
| 007 | VAP-VRTB-01_15-19 | Aqueous | 6:2 FTS | PFAS by ID | 30 | H | ng/L | 30 |
| 008 | VRTB-EB01-(091421) | Aqueous | 6:2 FTS | PFAS by ID | 5.6 | J | ng/L | 32 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | 6:2 FTS | PFAS by ID | 1.8 | J | ng/L | 34 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | PFBS | PFAS by ID | 8.9 | | ng/L | 34 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | PFHpS | PFAS by ID | 25 | | ng/L | 34 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | PFPeS | PFAS by ID | 16 | | ng/L | 34 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | PFHxS | PFAS by ID | 310 | | ng/L | 34 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | PFBA | PFAS by ID | 7.1 | | ng/L | 34 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | PFHpA | PFAS by ID | 8.1 | | ng/L | 34 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | PFHxA | PFAS by ID | 17 | | ng/L | 34 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | PFNA | PFAS by ID | 1.5 | J | ng/L | 34 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | PFOA | PFAS by ID | 35 | | ng/L | 34 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | PFPeA | PFAS by ID | 10 | | ng/L | 34 |
| 009 | VAP-VRTB-05_36-40 | Aqueous | PFOS | PFAS by ID | 470 | | ng/L | 34 |
| 010 | VAP-VRTB-05_31-35 | Aqueous | PFBS | PFAS by ID | 15 | | ng/L | 36 |
| 010 | VAP-VRTB-05_31-35 | Aqueous | PFHpS | PFAS by ID | 22 | | ng/L | 36 |
| 010 | VAP-VRTB-05_31-35 | Aqueous | PFPeS | PFAS by ID | 20 | | ng/L | 36 |
| 010 | VAP-VRTB-05_31-35 | Aqueous | PFHxS | PFAS by ID | 340 | | ng/L | 36 |
| 010 | VAP-VRTB-05_31-35 | Aqueous | PFBA | PFAS by ID | 13 | | ng/L | 36 |

# Detection Summary (Continued)

## Lot Number: WI18007

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 010 | VAP-VRTB-05_31-35 | Aqueous | PFHpA | PFAS by ID | 13 | | ng/L | 36 |
| 010 | VAP-VRTB-05_31-35 | Aqueous | PFHxA | PFAS by ID | 24 | | ng/L | 36 |
| 010 | VAP-VRTB-05_31-35 | Aqueous | PFNA | PFAS by ID | 1.3 | J | ng/L | 36 |
| 010 | VAP-VRTB-05_31-35 | Aqueous | PFOA | PFAS by ID | 38 | | ng/L | 36 |
| 010 | VAP-VRTB-05_31-35 | Aqueous | PFPeA | PFAS by ID | 15 | | ng/L | 36 |
| 010 | VAP-VRTB-05_31-35 | Aqueous | PFOS | PFAS by ID | 340 | | ng/L | 36 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | PFBS | PFAS by ID | 11 | | ng/L | 38 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | PFHpS | PFAS by ID | 17 | | ng/L | 38 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | PFPeS | PFAS by ID | 15 | | ng/L | 38 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | PFHxS | PFAS by ID | 320 | | ng/L | 38 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | PFBA | PFAS by ID | 12 | | ng/L | 38 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | PFHpA | PFAS by ID | 11 | | ng/L | 38 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | PFHxA | PFAS by ID | 20 | | ng/L | 38 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | PFNA | PFAS by ID | 1.0 | J | ng/L | 38 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | PFOA | PFAS by ID | 36 | | ng/L | 38 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | PFPeA | PFAS by ID | 13 | | ng/L | 38 |
| 011 | VAP-VRTB-05_26-30 | Aqueous | PFOS | PFAS by ID | 260 | | ng/L | 38 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | 8:2 FTS | PFAS by ID | 3.2 | J | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | 6:2 FTS | PFAS by ID | 2.5 | J | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | PFBS | PFAS by ID | 12 | | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | PFHpS | PFAS by ID | 16 | | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | PFPeS | PFAS by ID | 18 | | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | PFHxS | PFAS by ID | 280 | | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | PFBA | PFAS by ID | 13 | | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | PFHpA | PFAS by ID | 15 | | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | PFHxA | PFAS by ID | 22 | | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | PFNA | PFAS by ID | 3.6 | J | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | PFOA | PFAS by ID | 35 | | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | PFPeA | PFAS by ID | 15 | | ng/L | 40 |
| 012 | VAP-VRTB-05_21.5-25.5 | Aqueous | PFOS | PFAS by ID | 740 | | ng/L | 40 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | 8:2 FTS | PFAS by ID | 100 | | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | 6:2 FTS | PFAS by ID | 140 | | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFBS | PFAS by ID | 7.6 | | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFHpS | PFAS by ID | 81 | | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFPeS | PFAS by ID | 21 | | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFHxS | PFAS by ID | 1000 | | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFBA | PFAS by ID | 31 | | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFDA | PFAS by ID | 0.96 | J | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFHpA | PFAS by ID | 76 | | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFHxA | PFAS by ID | 96 | | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFNA | PFAS by ID | 78 | Q | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFOA | PFAS by ID | 200 | | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFPeA | PFAS by ID | 57 | | ng/L | 42 |
| 013 | VAP-VRTB-05_16.5-20.5 | Aqueous | PFOS | PFAS by ID | 18000 | | ng/L | 42 |
| 017 | VRTB-WB01-(091621) | Aqueous | PFBS | PFAS by ID | 1.2 | J | ng/L | 50 |
| 017 | VRTB-WB01-(091621) | Aqueous | PFPeS | PFAS by ID | 2.0 | J | ng/L | 50 |
| 017 | VRTB-WB01-(091621) | Aqueous | PFHxS | PFAS by ID | 15 | | ng/L | 50 |
| 017 | VRTB-WB01-(091621) | Aqueous | PFBA | PFAS by ID | 1.2 | J | ng/L | 50 |

# Detection Summary (Continued)

## Lot Number: WI18007

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 017 | VRTB-WB01-(091621) | Aqueous | PFHpA | PFAS by ID | 1.1 | J | ng/L | 50 |
| 017 | VRTB-WB01-(091621) | Aqueous | PFHxA | PFAS by ID | 3.7 | | ng/L | 50 |
| 017 | VRTB-WB01-(091621) | Aqueous | PFOA | PFAS by ID | 1.4 | J | ng/L | 50 |
| 017 | VRTB-WB01-(091621) | Aqueous | PFPeA | PFAS by ID | 2.7 | J | ng/L | 50 |

(143 detections)

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-001**

Description: **VAP-VRTB-02_36-40** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1345** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2123 | JJG | 10/08/2021 1611 | 18205 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/16/2021 1605 | MMM | 10/14/2021 1149 | 18749 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **2.1** | **J** | **8.0** | 4.0 | **2.0** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **1.3** | **J** | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **19** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **3.9** | **J** | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | UQ | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **1.4** | **J** | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **4.0** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **2.9** | **J** | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **2.1** | **J** | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | UQ | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | UQ | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **100** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 82 | 50-150 | H | 116 | 50-150 |
| 13C2_6:2FTS | | 80 | 50-150 | H | 98 | 50-150 |
| 13C2_8:2FTS | | 60 | 50-150 | H | 85 | 50-150 |
| 13C2_PFDoA | N | 36 | 50-150 | H | 72 | 50-150 |
| 13C2_PFTeDA | N | 43 | 50-150 | H | 63 | 50-150 |
| 13C3_PFBS | | 70 | 50-150 | H | 92 | 50-150 |
| 13C3_PFHxS | | 64 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | | 71 | 50-150 | H | 93 | 50-150 |
| 13C4_PFHpA | | 72 | 50-150 | H | 83 | 50-150 |
| 13C5_PFHxA | | 70 | 50-150 | H | 92 | 50-150 |
| 13C5_PFPeA | | 74 | 50-150 | H | 90 | 50-150 |
| 13C6_PFDA | | 62 | 50-150 | H | 92 | 50-150 |
| 13C7_PFUdA | | 52 | 50-150 | H | 83 | 50-150 |
| 13C8_PFOA | | 69 | 50-150 | H | 92 | 50-150 |
| 13C8_PFOS | | 64 | 50-150 | H | 87 | 50-150 |
| 13C8_PFOSA | | 68 | 50-150 | H | 92 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-001**

Description: **VAP-VRTB-02_36-40** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1345** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 67 | 50-150 | H | 93 | 50-150 |
| d5-EtFOSAA | | 51 | 50-150 | H | 85 | 50-150 |
| d-MeFOSA | | 51 | 50-150 | H | 76 | 50-150 |
| d3-MeFOSAA | | 53 | 50-150 | H | 82 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-001**

Description: **VAP-VRTB-02_36-40** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1345** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2123 | JJG | 10/08/2021 1611 | 18205 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/16/2021 1605 | MMM | 10/14/2021 1149 | 18749 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | UH | 7.0 | 3.5 | 1.7 | ng/L | 2 |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **2.2** | **HJ** | **7.0** | 3.5 | **1.7** | **ng/L** | **2** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | UH | 7.0 | 3.5 | 1.7 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | UH | 7.0 | 3.5 | 1.7 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.5 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | UH | 7.0 | 3.5 | 1.7 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **14** | **H** | **3.5** | 1.8 | **0.87** | **ng/L** | **2** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **3.6** | **H** | **3.5** | 1.8 | **0.87** | **ng/L** | **2** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **1.2** | **HJ** | **3.5** | 1.8 | **0.87** | **ng/L** | **2** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **2.9** | **HJ** | **3.5** | 1.8 | **0.87** | **ng/L** | **2** |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **2.5** | **HJ** | **3.5** | 1.8 | **0.87** | **ng/L** | **2** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **1.5** | **HJ** | **3.5** | 1.8 | **0.87** | **ng/L** | **2** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 2 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **73** | **BH** | **3.5** | 1.8 | **0.87** | **ng/L** | **2** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 82 | 50-150 | H | 116 | 50-150 |
| 13C2_6:2FTS | | 80 | 50-150 | H | 98 | 50-150 |
| 13C2_8:2FTS | | 60 | 50-150 | H | 85 | 50-150 |
| 13C2_PFDoA | N | 36 | 50-150 | H | 72 | 50-150 |
| 13C2_PFTeDA | N | 43 | 50-150 | H | 63 | 50-150 |
| 13C3_PFBS | | 70 | 50-150 | H | 92 | 50-150 |
| 13C3_PFHxS | | 64 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | | 71 | 50-150 | H | 93 | 50-150 |
| 13C4_PFHpA | | 72 | 50-150 | H | 83 | 50-150 |
| 13C5_PFHxA | | 70 | 50-150 | H | 92 | 50-150 |
| 13C5_PFPeA | | 74 | 50-150 | H | 90 | 50-150 |
| 13C6_PFDA | | 62 | 50-150 | H | 92 | 50-150 |
| 13C7_PFUdA | | 52 | 50-150 | H | 83 | 50-150 |
| 13C8_PFOA | | 69 | 50-150 | H | 92 | 50-150 |
| 13C8_PFOS | | 64 | 50-150 | H | 87 | 50-150 |
| 13C8_PFOSA | | 68 | 50-150 | H | 92 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-001**

Description: **VAP-VRTB-02_36-40** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1345** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 67 | 50-150 | H | 93 | 50-150 |
| d5-EtFOSAA | | 51 | 50-150 | H | 85 | 50-150 |
| d-MeFOSA | | 51 | 50-150 | H | 76 | 50-150 |
| d3-MeFOSAA | | 53 | 50-150 | H | 82 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-002**

Description: **VAP-VRTB-01_34.5-38.5** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1530** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2134 | JJG | 10/08/2021 1611 | 18205 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **1.1** | **J** | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **0.93** | **J** | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **1.2** | **J** | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **17** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **2.5** | **J** | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **1.3** | **J** | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **2.8** | **J** | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **2.4** | **J** | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **1.9** | **J** | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **150** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 87 | 50-150 |
| 13C2_6:2FTS | | 121 | 50-150 |
| 13C2_8:2FTS | | 75 | 50-150 |
| 13C2_PFDoA | | 59 | 50-150 |
| 13C2_PFTeDA | | 50 | 50-150 |
| 13C3_PFBS | | 76 | 50-150 |
| 13C3_PFHxS | | 68 | 50-150 |
| 13C4_PFBA | | 81 | 50-150 |
| 13C4_PFHpA | | 75 | 50-150 |
| 13C5_PFHxA | | 82 | 50-150 |
| 13C5_PFPeA | | 81 | 50-150 |
| 13C6_PFDA | | 77 | 50-150 |
| 13C7_PFUdA | | 73 | 50-150 |
| 13C8_PFOA | | 80 | 50-150 |
| 13C8_PFOS | | 68 | 50-150 |
| 13C8_PFOSA | | 77 | 50-150 |
| 13C9_PFNA | | 74 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-002**

Description: **VAP-VRTB-01_34.5-38.5** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1530** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 73 | 50-150 |
| d-MeFOSA | | 60 | 50-150 |
| d3-MeFOSAA | | 79 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-003**

Description: **VAP-VRTB-01_29.5-33.5** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1615** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2144 | JJG | 10/08/2021 1611 | 18205 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.6 | UQ | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **16** | | **3.5** | 1.8 | **0.89** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **2.2** | **J** | **3.5** | 1.8 | **0.89** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **1.6** | **J** | **3.5** | 1.8 | **0.89** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **2.5** | **J** | **3.5** | 1.8 | **0.89** | **ng/L** | **1** |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **2.3** | **J** | **3.5** | 1.8 | **0.89** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **2.1** | **J** | **3.5** | 1.8 | **0.89** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **37** | | **3.5** | 1.8 | **0.89** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 91 | 50-150 |
| 13C2_6:2FTS | N | 210 | 50-150 |
| 13C2_8:2FTS | | 79 | 50-150 |
| 13C2_PFDoA | | 71 | 50-150 |
| 13C2_PFTeDA | | 73 | 50-150 |
| 13C3_PFBS | | 87 | 50-150 |
| 13C3_PFHxS | | 83 | 50-150 |
| 13C4_PFBA | | 86 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 |
| 13C5_PFHxA | | 87 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 85 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 |
| 13C8_PFOS | | 82 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 |
| 13C9_PFNA | | 84 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-003**

Description: **VAP-VRTB-01_29.5-33.5** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1615** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 86 | 50-150 |
| d-MeFOSA | | 83 | 50-150 |
| d3-MeFOSAA | | 84 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-004**

Description: **VAP-VRTB-01_25-29** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1645** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2155 | JJG | 10/08/2021 1611 | 18205 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 6.5 | U | 13 | 6.5 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **1.7** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **1.5** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **2.6** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **44** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **5.2** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **6.8** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **9.5** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **1.1** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **11** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **10** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **58** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 119 | 50-150 |
| 13C2_8:2FTS | | 96 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 |
| 13C2_PFTeDA | | 91 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 |
| 13C3_PFHxS | | 90 | 50-150 |
| 13C4_PFBA | | 96 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 |
| 13C5_PFHxA | | 96 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 99 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 94 | 50-150 |
| 13C9_PFNA | | 90 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-004**

Description: **VAP-VRTB-01_25-29** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1645** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 86 | 50-150 |
| d3-MeFOSAA | | 91 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-005**

Description: **VAP-VRTB-DUP-01** Matrix: **Aqueous**

Date Sampled: **09/13/2021** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2205 | JJG | 10/08/2021 1611 | 18205 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/16/2021 1616 | MMM | 10/14/2021 1149 | 18749 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **1.8** | **JQ** | **6.8** | 3.4 | **1.7** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **5.7** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **2.2** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **8.0** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **77** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **13** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **11** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **16** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **1.1** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **15** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **17** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **95** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 95 | 50-150 | H | 114 | 50-150 |
| 13C2_6:2FTS | N | 151 | 50-150 | H | 95 | 50-150 |
| 13C2_8:2FTS | | 78 | 50-150 | H | 86 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 | H | 80 | 50-150 |
| 13C2_PFTeDA | | 87 | 50-150 | H | 83 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 | H | 94 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 | H | 102 | 50-150 |
| 13C4_PFBA | | 94 | 50-150 | H | 102 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 | H | 85 | 50-150 |
| 13C5_PFHxA | | 92 | 50-150 | H | 90 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 | H | 91 | 50-150 |
| 13C6_PFDA | | 92 | 50-150 | H | 91 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 | H | 85 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 | H | 100 | 50-150 |
| 13C8_PFOS | | 82 | 50-150 | H | 83 | 50-150 |
| 13C8_PFOSA | | 98 | 50-150 | H | 94 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-005**

Description: **VAP-VRTB-DUP-01** Matrix: **Aqueous**

Date Sampled: **09/13/2021** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 91 | 50-150 | H | 97 | 50-150 |
| d5-EtFOSAA | | 88 | 50-150 | H | 81 | 50-150 |
| d-MeFOSA | | 89 | 50-150 | H | 78 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 | H | 82 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-005**

Description: **VAP-VRTB-DUP-01** Matrix: **Aqueous**

Date Sampled: **09/13/2021** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2205 | JJG | 10/08/2021 1611 | 18205 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/16/2021 1616 | MMM | 10/14/2021 1149 | 18749 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.4 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **5.1** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **2** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **2.0** | **HJ** | **3.4** | 1.7 | **0.85** | **ng/L** | **2** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **7.1** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **2** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **69** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **2** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **12** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **2** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **11** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **2** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **15** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **2** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **0.98** | **HJ** | **3.4** | 1.7 | **0.85** | **ng/L** | **2** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **12** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **2** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **17** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **2** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **91** | **BH** | **3.4** | 1.7 | **0.85** | **ng/L** | **2** |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 95 | 50-150 | H | 114 | 50-150 |
| 13C2_6:2FTS | N | 151 | 50-150 | H | 95 | 50-150 |
| 13C2_8:2FTS | | 78 | 50-150 | H | 86 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 | H | 80 | 50-150 |
| 13C2_PFTeDA | | 87 | 50-150 | H | 83 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 | H | 94 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 | H | 102 | 50-150 |
| 13C4_PFBA | | 94 | 50-150 | H | 102 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 | H | 85 | 50-150 |
| 13C5_PFHxA | | 92 | 50-150 | H | 90 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 | H | 91 | 50-150 |
| 13C6_PFDA | | 92 | 50-150 | H | 91 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 | H | 85 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 | H | 100 | 50-150 |
| 13C8_PFOS | | 82 | 50-150 | H | 83 | 50-150 |
| 13C8_PFOSA | | 98 | 50-150 | H | 94 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-005**

Description: **VAP-VRTB-DUP-01** Matrix: **Aqueous**

Date Sampled: **09/13/2021** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 91 | 50-150 | H | 97 | 50-150 |
| d5-EtFOSAA | | 88 | 50-150 | H | 81 | 50-150 |
| d-MeFOSA | | 89 | 50-150 | H | 78 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 | H | 82 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-006**

Description: **VAP-VRTB-01_20-24** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1715** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2216 | JJG | 10/08/2021 1611 | 18205 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **4.9** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **2.2** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **6.9** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **76** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **13** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **11** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **17** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **0.99** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **15** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **18** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **94** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 89 | 50-150 |
| 13C2_6:2FTS | N | 173 | 50-150 |
| 13C2_8:2FTS | | 77 | 50-150 |
| 13C2_PFDoA | | 71 | 50-150 |
| 13C2_PFTeDA | | 78 | 50-150 |
| 13C3_PFBS | | 92 | 50-150 |
| 13C3_PFHxS | | 82 | 50-150 |
| 13C4_PFBA | | 88 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 |
| 13C5_PFHxA | | 86 | 50-150 |
| 13C5_PFPeA | | 90 | 50-150 |
| 13C6_PFDA | | 82 | 50-150 |
| 13C7_PFUdA | | 86 | 50-150 |
| 13C8_PFOA | | 91 | 50-150 |
| 13C8_PFOS | | 82 | 50-150 |
| 13C8_PFOSA | | 87 | 50-150 |
| 13C9_PFNA | | 86 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-006**

Description: **VAP-VRTB-01_20-24** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1715** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 69 | 50-150 |
| d3-MeFOSAA | | 83 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-007**

Description: **VAP-VRTB-01_15-19** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1750** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2226 | JJG | 10/08/2021 1611 | 18205 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 10/12/2021 1558 | JJG | 10/08/2021 1611 | 18205 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/16/2021 1626 | MMM | 10/14/2021 1149 | 18749 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| **1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)** | **39108-34-4** | **PFAS by ID SOP** | **50** | | **6.8** | 3.4 | **1.7** | **ng/L** | **1** |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **28** | | **6.8** | 3.4 | **1.7** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **7.3** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **36** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | US | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-1-octanesulfonamide (PFOSA)** | **754-91-6** | **PFAS by ID SOP** | **1.8** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **15** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **550** | **S** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **23** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **58** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **64** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **42** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **95** | **S** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **42** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **7100** | **ES** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 | | 102 | 50-150 | H | 122 | 50-150 |
| 13C2_6:2FTS | | 127 | 50-150 | | 106 | 50-150 | H | 108 | 50-150 |
| 13C2_8:2FTS | | 81 | 50-150 | | 99 | 50-150 | H | 88 | 50-150 |
| 13C2_PFDoA | | 74 | 50-150 | | 96 | 50-150 | H | 82 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 | | 102 | 50-150 | H | 87 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 | | 93 | 50-150 | H | 99 | 50-150 |
| 13C3_PFHxS | | 81 | 50-150 | | 95 | 50-150 | H | 107 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 | | 100 | 50-150 | H | 105 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 | | 104 | 50-150 | H | 90 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 | | 103 | 50-150 | H | 97 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 | | 99 | 50-150 | H | 97 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 | | 98 | 50-150 | H | 97 | 50-150 |
| 13C7_PFUdA | | 86 | 50-150 | | 107 | 50-150 | H | 90 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 | | 100 | 50-150 | H | 104 | 50-150 |
| 13C8_PFOS | | 65 | 50-150 | | 98 | 50-150 | H | 62 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-007**

Description: **VAP-VRTB-01_15-19** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1750** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 93 | 50-150 | | 106 | 50-150 | H | 102 | 50-150 |
| 13C9_PFNA | | 62 | 50-150 | | 91 | 50-150 | H | 71 | 50-150 |
| d5-EtFOSAA | | 88 | 50-150 | | 106 | 50-150 | H | 91 | 50-150 |
| d-MeFOSA | | 80 | 50-150 | | 102 | 50-150 | H | 78 | 50-150 |
| d3-MeFOSAA | | 86 | 50-150 | | 102 | 50-150 | H | 90 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-007**

Description: **VAP-VRTB-01_15-19** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1750** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2226 | JJG | 10/08/2021 1611 | 18205 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 10/12/2021 1558 | JJG | 10/08/2021 1611 | 18205 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/16/2021 1626 | MMM | 10/14/2021 1149 | 18749 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| **1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)** | **39108-34-4** | **PFAS by ID SOP** | **51** | **J** | **140** | 70 | **34** | **ng/L** | **2** |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **41** | **J** | **140** | 70 | **34** | **ng/L** | **2** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 70 | U | 140 | 70 | 34 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 70 | U | 140 | 70 | 34 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 140 | U | 270 | 140 | 68 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 70 | U | 140 | 70 | 34 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **42** | **J** | **68** | 34 | **17** | **ng/L** | **2** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **22** | **J** | **68** | 34 | **17** | **ng/L** | **2** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **630** | | **68** | 34 | **17** | **ng/L** | **2** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **29** | **J** | **68** | 34 | **17** | **ng/L** | **2** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **66** | **J** | **68** | 34 | **17** | **ng/L** | **2** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **68** | | **68** | 34 | **17** | **ng/L** | **2** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **49** | **J** | **68** | 34 | **17** | **ng/L** | **2** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **110** | | **68** | 34 | **17** | **ng/L** | **2** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **49** | **J** | **68** | 34 | **17** | **ng/L** | **2** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **7300** | | **68** | 34 | **17** | **ng/L** | **2** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 | | 102 | 50-150 | H | 122 | 50-150 |
| 13C2_6:2FTS | | 127 | 50-150 | | 106 | 50-150 | H | 108 | 50-150 |
| 13C2_8:2FTS | | 81 | 50-150 | | 99 | 50-150 | H | 88 | 50-150 |
| 13C2_PFDoA | | 74 | 50-150 | | 96 | 50-150 | H | 82 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 | | 102 | 50-150 | H | 87 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 | | 93 | 50-150 | H | 99 | 50-150 |
| 13C3_PFHxS | | 81 | 50-150 | | 95 | 50-150 | H | 107 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 | | 100 | 50-150 | H | 105 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 | | 104 | 50-150 | H | 90 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 | | 103 | 50-150 | H | 97 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 | | 99 | 50-150 | H | 97 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 | | 98 | 50-150 | H | 97 | 50-150 |
| 13C7_PFUdA | | 86 | 50-150 | | 107 | 50-150 | H | 90 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 | | 100 | 50-150 | H | 104 | 50-150 |
| 13C8_PFOS | | 65 | 50-150 | | 98 | 50-150 | H | 62 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-007**

Description: **VAP-VRTB-01_15-19** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1750** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 93 | 50-150 | | 106 | 50-150 | H | 102 | 50-150 |
| 13C9_PFNA | | 62 | 50-150 | | 91 | 50-150 | H | 71 | 50-150 |
| d5-EtFOSAA | | 88 | 50-150 | | 106 | 50-150 | H | 91 | 50-150 |
| d-MeFOSA | | 80 | 50-150 | | 102 | 50-150 | H | 78 | 50-150 |
| d3-MeFOSAA | | 86 | 50-150 | | 102 | 50-150 | H | 90 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-007**

Description: **VAP-VRTB-01_15-19** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1750** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/09/2021 2226 | JJG | 10/08/2021 1611 | 18205 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 10/12/2021 1558 | JJG | 10/08/2021 1611 | 18205 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/16/2021 1626 | MMM | 10/14/2021 1149 | 18749 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| **1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)** | **39108-34-4** | **PFAS by ID SOP** | **56** | **HS** | **6.8** | 3.4 | **1.7** | **ng/L** | **3** |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **30** | **H** | **6.8** | 3.4 | **1.7** | **ng/L** | **3** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.4 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **7.1** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **3** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **34** | **HS** | **3.4** | 1.7 | **0.85** | **ng/L** | **3** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UHS | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **15** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **3** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **490** | **HS** | **3.4** | 1.7 | **0.85** | **ng/L** | **3** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **22** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **3** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **60** | **HS** | **3.4** | 1.7 | **0.85** | **ng/L** | **3** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **60** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **3** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **46** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **3** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **91** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **3** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **42** | **H** | **3.4** | 1.7 | **0.85** | **ng/L** | **3** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **6900** | **BHES** | **3.4** | 1.7 | **0.85** | **ng/L** | **3** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 | | 102 | 50-150 | H | 122 | 50-150 |
| 13C2_6:2FTS | | 127 | 50-150 | | 106 | 50-150 | H | 108 | 50-150 |
| 13C2_8:2FTS | | 81 | 50-150 | | 99 | 50-150 | H | 88 | 50-150 |
| 13C2_PFDoA | | 74 | 50-150 | | 96 | 50-150 | H | 82 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 | | 102 | 50-150 | H | 87 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 | | 93 | 50-150 | H | 99 | 50-150 |
| 13C3_PFHxS | | 81 | 50-150 | | 95 | 50-150 | H | 107 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 | | 100 | 50-150 | H | 105 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 | | 104 | 50-150 | H | 90 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 | | 103 | 50-150 | H | 97 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 | | 99 | 50-150 | H | 97 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 | | 98 | 50-150 | H | 97 | 50-150 |
| 13C7_PFUdA | | 86 | 50-150 | | 107 | 50-150 | H | 90 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 | | 100 | 50-150 | H | 104 | 50-150 |
| 13C8_PFOS | | 65 | 50-150 | | 98 | 50-150 | H | 62 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-007**

Description: **VAP-VRTB-01_15-19** Matrix: **Aqueous**

Date Sampled: **09/13/2021 1750** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 93 | 50-150 | | 106 | 50-150 | H | 102 | 50-150 |
| 13C9_PFNA | | 62 | 50-150 | | 91 | 50-150 | H | 71 | 50-150 |
| d5-EtFOSAA | | 88 | 50-150 | | 106 | 50-150 | H | 91 | 50-150 |
| d-MeFOSA | | 80 | 50-150 | | 102 | 50-150 | H | 78 | 50-150 |
| d3-MeFOSAA | | 86 | 50-150 | | 102 | 50-150 | H | 90 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-008**

Description: **VRTB-EB01-(091421)** Matrix: **Aqueous**

Date Sampled: **09/14/2021 0900** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/12/2021 1537 | JJG | 10/11/2021 1143 | 18329 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **5.6** | **J** | **7.1** | 3.6 | **1.8** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 |
| 13C2_6:2FTS | | 147 | 50-150 |
| 13C2_8:2FTS | | 106 | 50-150 |
| 13C2_PFDoA | | 99 | 50-150 |
| 13C2_PFTeDA | | 92 | 50-150 |
| 13C3_PFBS | | 102 | 50-150 |
| 13C3_PFHxS | | 111 | 50-150 |
| 13C4_PFBA | | 105 | 50-150 |
| 13C4_PFHpA | | 108 | 50-150 |
| 13C5_PFHxA | | 113 | 50-150 |
| 13C5_PFPeA | | 109 | 50-150 |
| 13C6_PFDA | | 101 | 50-150 |
| 13C7_PFUdA | | 102 | 50-150 |
| 13C8_PFOA | | 112 | 50-150 |
| 13C8_PFOS | | 104 | 50-150 |
| 13C8_PFOSA | | 108 | 50-150 |
| 13C9_PFNA | | 101 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-008**

Description: **VRTB-EB01-(091421)** Matrix: **Aqueous**

Date Sampled: **09/14/2021 0900** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 107 | 50-150 |
| d-MeFOSA | | 94 | 50-150 |
| d3-MeFOSAA | | 103 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-009**

Description: **VAP-VRTB-05_36-40** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1040** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/12/2021 1630 | JJG | 10/11/2021 1143 | 18329 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **1.8** | **J** | **6.8** | 3.4 | **1.7** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **8.9** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **25** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **16** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **310** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **7.1** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **8.1** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **17** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **1.5** | **J** | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **35** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **10** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **470** | | **3.4** | 1.7 | **0.86** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 |
| 13C2_6:2FTS | | 118 | 50-150 |
| 13C2_8:2FTS | | 91 | 50-150 |
| 13C2_PFDoA | | 76 | 50-150 |
| 13C2_PFTeDA | | 65 | 50-150 |
| 13C3_PFBS | | 81 | 50-150 |
| 13C3_PFHxS | | 82 | 50-150 |
| 13C4_PFBA | | 91 | 50-150 |
| 13C4_PFHpA | | 90 | 50-150 |
| 13C5_PFHxA | | 86 | 50-150 |
| 13C5_PFPeA | | 86 | 50-150 |
| 13C6_PFDA | | 94 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 |
| 13C8_PFOA | | 91 | 50-150 |
| 13C8_PFOS | | 82 | 50-150 |
| 13C8_PFOSA | | 88 | 50-150 |
| 13C9_PFNA | | 82 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-009**

Description: **VAP-VRTB-05_36-40** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1040** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 90 | 50-150 |
| d-MeFOSA | | 78 | 50-150 |
| d3-MeFOSAA | | 90 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-010**

Description: **VAP-VRTB-05_31-35** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1120** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/12/2021 1641 | JJG | 10/11/2021 1143 | 18329 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **15** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **22** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **20** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **340** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **13** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **13** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **24** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **1.3** | **J** | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **38** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **15** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **340** | | **3.5** | 1.8 | **0.87** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 101 | 50-150 |
| 13C2_6:2FTS | | 125 | 50-150 |
| 13C2_8:2FTS | | 91 | 50-150 |
| 13C2_PFDoA | | 70 | 50-150 |
| 13C2_PFTeDA | | 53 | 50-150 |
| 13C3_PFBS | | 87 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 |
| 13C4_PFHpA | | 89 | 50-150 |
| 13C5_PFHxA | | 86 | 50-150 |
| 13C5_PFPeA | | 85 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 82 | 50-150 |
| 13C8_PFOA | | 91 | 50-150 |
| 13C8_PFOS | | 81 | 50-150 |
| 13C8_PFOSA | | 96 | 50-150 |
| 13C9_PFNA | | 83 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-010**

Description: **VAP-VRTB-05_31-35** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1120** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 85 | 50-150 |
| d-MeFOSA | | 78 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-011**

Description: **VAP-VRTB-05_26-30** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1155** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/12/2021 1651 | JJG | 10/11/2021 1143 | 18329 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **11** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **17** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **15** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **320** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **12** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **11** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **20** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **1.0** | **J** | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **36** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **13** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **260** | | **3.4** | 1.7 | **0.85** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 147 | 50-150 |
| 13C2_8:2FTS | | 82 | 50-150 |
| 13C2_PFDoA | | 58 | 50-150 |
| 13C2_PFTeDA | | 55 | 50-150 |
| 13C3_PFBS | | 84 | 50-150 |
| 13C3_PFHxS | | 80 | 50-150 |
| 13C4_PFBA | | 90 | 50-150 |
| 13C4_PFHpA | | 91 | 50-150 |
| 13C5_PFHxA | | 87 | 50-150 |
| 13C5_PFPeA | | 86 | 50-150 |
| 13C6_PFDA | | 82 | 50-150 |
| 13C7_PFUdA | | 76 | 50-150 |
| 13C8_PFOA | | 94 | 50-150 |
| 13C8_PFOS | | 83 | 50-150 |
| 13C8_PFOSA | | 91 | 50-150 |
| 13C9_PFNA | | 82 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-011**

Description: **VAP-VRTB-05_26-30** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1155** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 79 | 50-150 |
| d-MeFOSA | | 66 | 50-150 |
| d3-MeFOSAA | | 82 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-012**

Description: **VAP-VRTB-05_21.5-25.5** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1225** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/12/2021 1702 | JJG | 10/11/2021 1143 | 18329 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| **1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)** | **39108-34-4** | **PFAS by ID SOP** | **3.2** | **J** | **8.1** | 4.1 | **2.0** | **ng/L** | **1** |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **2.5** | **J** | **8.1** | 4.1 | **2.0** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **12** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **16** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **18** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **280** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **13** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **15** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **22** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **3.6** | **J** | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **35** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **15** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **740** | | **4.0** | 2.0 | **1.0** | **ng/L** | **1** |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 87 | 50-150 |
| 13C2_6:2FTS | | 107 | 50-150 |
| 13C2_8:2FTS | | 76 | 50-150 |
| 13C2_PFDoA | | 50 | 50-150 |
| 13C2_PFTeDA | | 54 | 50-150 |
| 13C3_PFBS | | 79 | 50-150 |
| 13C3_PFHxS | | 82 | 50-150 |
| 13C4_PFBA | | 84 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 |
| 13C5_PFHxA | | 85 | 50-150 |
| 13C5_PFPeA | | 86 | 50-150 |
| 13C6_PFDA | | 77 | 50-150 |
| 13C7_PFUdA | | 61 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 |
| 13C8_PFOS | | 76 | 50-150 |
| 13C8_PFOSA | | 87 | 50-150 |
| 13C9_PFNA | | 74 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-012**

Description: **VAP-VRTB-05_21.5-25.5** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1225** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 62 | 50-150 |
| d-MeFOSA | | 52 | 50-150 |
| d3-MeFOSAA | | 65 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-013**

Description: **VAP-VRTB-05_16.5-20.5** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1245** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/12/2021 1712 | JJG | 10/11/2021 1143 | 18329 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 10/14/2021 1925 | JJG | 10/11/2021 1143 | 18329 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| **1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)** | **39108-34-4** | **PFAS by ID SOP** | **100** | | **7.0** | 3.5 | **1.8** | **ng/L** | **1** |
| **1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)** | **27619-97-2** | **PFAS by ID SOP** | **140** | | **7.0** | 3.5 | **1.8** | **ng/L** | **1** |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **7.6** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| **Perfluoro-1-heptanesulfonic acid (PFHpS)** | **375-92-8** | **PFAS by ID SOP** | **81** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **21** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **1000** | | **350** | 180 | **88** | **ng/L** | **2** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **31** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluoro-n-decanoic acid (PFDA)** | **335-76-2** | **PFAS by ID SOP** | **0.96** | **J** | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **76** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **96** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluoro-n-nonanoic acid (PFNA)** | **375-95-1** | **PFAS by ID SOP** | **78** | **Q** | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **200** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **57** | | **3.5** | 1.8 | **0.88** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| **Perfluorooctanesulfonic acid (PFOS)** | **1763-23-1** | **PFAS by ID SOP** | **18000** | | **350** | 180 | **88** | **ng/L** | **2** |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 104 | 50-150 | | 95 | 50-150 |
| 13C2_6:2FTS | | 115 | 50-150 | | 102 | 50-150 |
| 13C2_8:2FTS | | 91 | 50-150 | | 94 | 50-150 |
| 13C2_PFDoA | | 76 | 50-150 | | 85 | 50-150 |
| 13C2_PFTeDA | | 72 | 50-150 | | 97 | 50-150 |
| 13C3_PFBS | | 88 | 50-150 | | 100 | 50-150 |
| 13C3_PFHxS | | 83 | 50-150 | | 106 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 | | 95 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 | | 98 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 | | 99 | 50-150 |
| 13C5_PFPeA | | 91 | 50-150 | | 101 | 50-150 |
| 13C6_PFDA | | 92 | 50-150 | | 93 | 50-150 |
| 13C7_PFUdA | | 84 | 50-150 | | 89 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 | | 96 | 50-150 |
| 13C8_PFOS | N | 46 | 50-150 | | 92 | 50-150 |
| 13C8_PFOSA | | 98 | 50-150 | | 99 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-013**

Description: **VAP-VRTB-05_16.5-20.5** Matrix: **Aqueous**

Date Sampled: **09/14/2021 1245** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | N | 42 | 50-150 | | 98 | 50-150 |
| d5-EtFOSAA | | 90 | 50-150 | | 101 | 50-150 |
| d-MeFOSA | | 66 | 50-150 | | 103 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 | | 108 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-014**

Description: **VRTB-EB02-(091621)** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1110** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/14/2021 1605 | JJG | 10/12/2021 1201 | 18442 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 |
| 13C2_6:2FTS | N | 171 | 50-150 |
| 13C2_8:2FTS | | 89 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 |
| 13C2_PFTeDA | | 93 | 50-150 |
| 13C3_PFBS | | 101 | 50-150 |
| 13C3_PFHxS | | 102 | 50-150 |
| 13C4_PFBA | | 99 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 |
| 13C8_PFOA | | 111 | 50-150 |
| 13C8_PFOS | | 99 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 103 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-014**

Description: **VRTB-EB02-(091621)** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1110** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 102 | 50-150 |
| d-MeFOSA | | 66 | 50-150 |
| d3-MeFOSAA | | 103 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-015**

Description: **VRTB-EB03-(091621)** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1215** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/14/2021 1626 | JJG | 10/12/2021 1201 | 18442 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 116 | 50-150 |
| 13C2_6:2FTS | | 130 | 50-150 |
| 13C2_8:2FTS | | 99 | 50-150 |
| 13C2_PFDoA | | 90 | 50-150 |
| 13C2_PFTeDA | | 98 | 50-150 |
| 13C3_PFBS | | 109 | 50-150 |
| 13C3_PFHxS | | 110 | 50-150 |
| 13C4_PFBA | | 111 | 50-150 |
| 13C4_PFHpA | | 108 | 50-150 |
| 13C5_PFHxA | | 115 | 50-150 |
| 13C5_PFPeA | | 112 | 50-150 |
| 13C6_PFDA | | 105 | 50-150 |
| 13C7_PFUdA | | 100 | 50-150 |
| 13C8_PFOA | | 110 | 50-150 |
| 13C8_PFOS | | 110 | 50-150 |
| 13C8_PFOSA | | 113 | 50-150 |
| 13C9_PFNA | | 116 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-015**

Description: **VRTB-EB03-(091621)** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1215** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 109 | 50-150 |
| d-MeFOSA | | 75 | 50-150 |
| d3-MeFOSAA | | 108 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-016**

Description: **VRTB-EB04-(091621)** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1230** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/14/2021 1647 | JJG | 10/12/2021 1201 | 18442 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 |
| 13C2_6:2FTS | N | 163 | 50-150 |
| 13C2_8:2FTS | | 84 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 |
| 13C2_PFTeDA | | 92 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 |
| 13C3_PFHxS | | 109 | 50-150 |
| 13C4_PFBA | | 96 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 |
| 13C6_PFDA | | 95 | 50-150 |
| 13C7_PFUdA | | 90 | 50-150 |
| 13C8_PFOA | | 109 | 50-150 |
| 13C8_PFOS | | 97 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 |
| 13C9_PFNA | | 106 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-016**

Description: **VRTB-EB04-(091621)** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1230** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 98 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 98 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-017**

Description: **VRTB-WB01-(091621)** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1400** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/24/2021 1535 | JJG | 10/12/2021 1201 | 18442 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 6.5 | U | 13 | 6.5 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| **Perfluoro-1-butanesulfonic acid (PFBS)** | **375-73-5** | **PFAS by ID SOP** | **1.2** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-1-pentanesulfonic acid (PFPeS)** | **2706-91-4** | **PFAS by ID SOP** | **2.0** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluorohexanesulfonic acid (PFHxS)** | **355-46-4** | **PFAS by ID SOP** | **15** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-butanoic acid (PFBA)** | **375-22-4** | **PFAS by ID SOP** | **1.2** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-n-heptanoic acid (PFHpA)** | **375-85-9** | **PFAS by ID SOP** | **1.1** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-hexanoic acid (PFHxA)** | **307-24-4** | **PFAS by ID SOP** | **3.7** | | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| **Perfluoro-n-octanoic acid (PFOA)** | **335-67-1** | **PFAS by ID SOP** | **1.4** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| **Perfluoro-n-pentanoic acid (PFPeA)** | **2706-90-3** | **PFAS by ID SOP** | **2.7** | **J** | **3.4** | 1.7 | **0.84** | **ng/L** | **1** |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 |
| 13C2_6:2FTS | | 127 | 50-150 |
| 13C2_8:2FTS | | 101 | 50-150 |
| 13C2_PFDoA | | 89 | 50-150 |
| 13C2_PFTeDA | | 96 | 50-150 |
| 13C3_PFBS | | 106 | 50-150 |
| 13C3_PFHxS | | 103 | 50-150 |
| 13C4_PFBA | | 104 | 50-150 |
| 13C4_PFHpA | | 103 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 |
| 13C5_PFPeA | | 97 | 50-150 |
| 13C6_PFDA | | 104 | 50-150 |
| 13C7_PFUdA | | 100 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 |
| 13C8_PFOS | | 96 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI18007-017**

Description: **VRTB-WB01-(091621)** Matrix: **Aqueous**

Date Sampled: **09/16/2021 1400** Project Name: **ESTCP Vertebrae**

Date Received: **09/18/2021** Project Number: **30027244**

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 91 | 50-150 |
| d-MeFOSA | | 87 | 50-150 |
| d3-MeFOSAA | | 95 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18205-001
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/09/2021 1824 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/09/2021 1824 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/09/2021 1824 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/09/2021 1824 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/09/2021 1824 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/09/2021 1824 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/09/2021 1824 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 94 | 50-150 |
| 13C2_6:2FTS | | 116 | 50-150 |
| 13C2_8:2FTS | | 79 | 50-150 |
| 13C2_PFDoA | | 74 | 50-150 |
| 13C2_PFTeDA | | 77 | 50-150 |
| 13C3_PFBS | | 88 | 50-150 |
| 13C3_PFHxS | | 83 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 84 | 50-150 |
| 13C5_PFHxA | | 88 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18205-001
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 84 | 50-150 |
| 13C8_PFOSA | | 90 | 50-150 |
| 13C9_PFNA | | 87 | 50-150 |
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 69 | 50-150 |
| d3-MeFOSAA | | 81 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18205-002
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 19 | | 1 | 127 | 67-138 | 10/09/2021 1835 |
| 6:2 FTS | 15 | 14 | | 1 | 94 | 64-140 | 10/09/2021 1835 |
| 4:2 FTS | 15 | 15 | | 1 | 104 | 63-143 | 10/09/2021 1835 |
| EtFOSAA | 16 | 17 | | 1 | 104 | 61-135 | 10/09/2021 1835 |
| MeFOSA | 16 | 16 | | 1 | 98 | 68-141 | 10/09/2021 1835 |
| MeFOSAA | 16 | 18 | | 1 | 110 | 65-136 | 10/09/2021 1835 |
| PFBS | 14 | 14 | | 1 | 101 | 72-130 | 10/09/2021 1835 |
| PFDS | 15 | 15 | | 1 | 99 | 53-142 | 10/09/2021 1835 |
| PFHpS | 15 | 16 | | 1 | 102 | 69-134 | 10/09/2021 1835 |
| PFNS | 15 | 18 | | 1 | 118 | 69-127 | 10/09/2021 1835 |
| PFOSA | 16 | 16 | | 1 | 101 | 67-137 | 10/09/2021 1835 |
| PFPeS | 15 | 15 | | 1 | 98 | 71-127 | 10/09/2021 1835 |
| PFHxS | 15 | 15 | | 1 | 100 | 68-131 | 10/09/2021 1835 |
| PFBA | 16 | 16 | | 1 | 103 | 73-129 | 10/09/2021 1835 |
| PFDA | 16 | 16 | | 1 | 98 | 71-129 | 10/09/2021 1835 |
| PFDoA | 16 | 16 | | 1 | 102 | 72-134 | 10/09/2021 1835 |
| PFHpA | 16 | 16 | | 1 | 100 | 72-130 | 10/09/2021 1835 |
| PFHxA | 16 | 15 | | 1 | 97 | 72-129 | 10/09/2021 1835 |
| PFNA | 16 | 16 | | 1 | 103 | 69-130 | 10/09/2021 1835 |
| PFOA | 16 | 16 | | 1 | 102 | 71-133 | 10/09/2021 1835 |
| PFPeA | 16 | 16 | | 1 | 102 | 72-129 | 10/09/2021 1835 |
| PFTeDA | 16 | 16 | | 1 | 103 | 71-132 | 10/09/2021 1835 |
| PFTrDA | 16 | 17 | | 1 | 104 | 65-144 | 10/09/2021 1835 |
| PFUdA | 16 | 17 | | 1 | 107 | 69-133 | 10/09/2021 1835 |
| PFOS | 15 | 16 | | 1 | 106 | 65-140 | 10/09/2021 1835 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 86 | 50-150 |
| 13C2_6:2FTS | N | 165 | 50-150 |
| 13C2_8:2FTS | | 69 | 50-150 |
| 13C2_PFDoA | | 69 | 50-150 |
| 13C2_PFTeDA | | 78 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 |
| 13C3_PFHxS | | 79 | 50-150 |
| 13C4_PFBA | | 81 | 50-150 |
| 13C4_PFHpA | | 81 | 50-150 |
| 13C5_PFHxA | | 86 | 50-150 |
| 13C5_PFPeA | | 84 | 50-150 |
| 13C6_PFDA | | 84 | 50-150 |
| 13C7_PFUdA | | 75 | 50-150 |
| 13C8_PFOA | | 86 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18205-002
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 75 | 50-150 |
| 13C8_PFOSA | | 81 | 50-150 |
| 13C9_PFNA | | 79 | 50-150 |
| d5-EtFOSAA | | 75 | 50-150 |
| d-MeFOSA | | 62 | 50-150 |
| d3-MeFOSAA | | 79 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MS

**Sample ID:** WI18007-007MS
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 50 | 13 | 66 | | 1 | 120 | 67-138 | 10/09/2021 2237 |
| 6:2 FTS | 28 | 13 | 39 | | 1 | 80 | 64-140 | 10/09/2021 2237 |
| 4:2 FTS | ND | 13 | 12 | | 1 | 95 | 63-143 | 10/09/2021 2237 |
| EtFOSAA | ND | 14 | 13 | | 1 | 95 | 61-135 | 10/09/2021 2237 |
| MeFOSA | ND | 14 | 13 | | 1 | 98 | 68-141 | 10/09/2021 2237 |
| MeFOSAA | ND | 14 | 13 | | 1 | 93 | 65-136 | 10/09/2021 2237 |
| PFBS | 7.3 | 12 | 19 | | 1 | 97 | 72-130 | 10/09/2021 2237 |
| PFDS | ND | 13 | 18 | | 1 | 136 | 53-142 | 10/09/2021 2237 |
| PFHpS | 36 | 13 | 46 | | 1 | 76 | 69-134 | 10/09/2021 2237 |
| PFNS | ND | 13 | 20 | N | 1 | 153 | 69-127 | 10/09/2021 2237 |
| PFOSA | 1.8 | 14 | 15 | | 1 | 98 | 67-137 | 10/09/2021 2237 |
| PFPeS | 15 | 13 | 28 | | 1 | 100 | 71-127 | 10/09/2021 2237 |
| PFHxS | 550 | 12 | 570 | N | 1 | 173 | 68-131 | 10/09/2021 2237 |
| PFBA | 23 | 14 | 35 | | 1 | 94 | 73-129 | 10/09/2021 2237 |
| PFDA | ND | 14 | 14 | | 1 | 101 | 71-129 | 10/09/2021 2237 |
| PFDoA | ND | 14 | 14 | | 1 | 100 | 72-134 | 10/09/2021 2237 |
| PFHpA | 58 | 14 | 71 | | 1 | 90 | 72-130 | 10/09/2021 2237 |
| PFHxA | 64 | 14 | 77 | | 1 | 96 | 72-129 | 10/09/2021 2237 |
| PFNA | 42 | 14 | 54 | | 1 | 91 | 69-130 | 10/09/2021 2237 |
| PFOA | 95 | 14 | 97 | N | 1 | 16 | 71-133 | 10/09/2021 2237 |
| PFPeA | 42 | 14 | 56 | | 1 | 107 | 72-129 | 10/09/2021 2237 |
| PFTeDA | ND | 14 | 14 | | 1 | 101 | 71-132 | 10/09/2021 2237 |
| PFTrDA | ND | 14 | 14 | | 1 | 104 | 65-144 | 10/09/2021 2237 |
| PFUdA | ND | 14 | 14 | | 1 | 105 | 69-133 | 10/09/2021 2237 |
| PFOS | 7100 | 13 | 7200 | N | 1 | 537 | 65-140 | 10/09/2021 2237 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 |
| 13C2_6:2FTS | N | 157 | 50-150 |
| 13C2_8:2FTS | | 87 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 87 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 87 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 90 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 98 | 50-150 |
| 13C6_PFDA | | 94 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 |
| 13C8_PFOA | | 94 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MS

**Sample ID:** WI18007-007MS
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 66 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 |
| 13C9_PFNA | | 67 | 50-150 |
| d5-EtFOSAA | | 98 | 50-150 |
| d-MeFOSA | | 78 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MSD

**Sample ID:** WI18007-007MD
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 50 | 13 | 65 | | 1 | 116 | 0.45 | 67-138 | 30 | 10/09/2021 2247 |
| 6:2 FTS | 28 | 13 | 38 | | 1 | 74 | 1.3 | 64-140 | 30 | 10/09/2021 2247 |
| 4:2 FTS | ND | 13 | 13 | | 1 | 99 | 6.4 | 63-143 | 30 | 10/09/2021 2247 |
| EtFOSAA | ND | 14 | 14 | | 1 | 102 | 9.8 | 61-135 | 30 | 10/09/2021 2247 |
| MeFOSA | ND | 14 | 13 | | 1 | 98 | 2.0 | 68-141 | 30 | 10/09/2021 2247 |
| MeFOSAA | ND | 14 | 14 | | 1 | 100 | 8.6 | 65-136 | 30 | 10/09/2021 2247 |
| PFBS | 7.3 | 12 | 19 | | 1 | 99 | 2.4 | 72-130 | 30 | 10/09/2021 2247 |
| PFDS | ND | 13 | 17 | | 1 | 130 | 2.6 | 53-142 | 30 | 10/09/2021 2247 |
| PFHpS | 36 | 13 | 47 | | 1 | 81 | 2.1 | 69-134 | 30 | 10/09/2021 2247 |
| PFNS | ND | 13 | 21 | N | 1 | 156 | 4.2 | 69-127 | 30 | 10/09/2021 2247 |
| PFOSA | 1.8 | 14 | 15 | | 1 | 97 | 0.50 | 67-137 | 30 | 10/09/2021 2247 |
| PFPeS | 15 | 13 | 28 | | 1 | 97 | 0.61 | 71-127 | 30 | 10/09/2021 2247 |
| PFHxS | 550 | 13 | 540 | N | 1 | -137 | 6.9 | 68-131 | 30 | 10/09/2021 2247 |
| PFBA | 23 | 14 | 36 | | 1 | 98 | 2.4 | 73-129 | 30 | 10/09/2021 2247 |
| PFDA | ND | 14 | 14 | | 1 | 104 | 5.0 | 71-129 | 30 | 10/09/2021 2247 |
| PFDoA | ND | 14 | 15 | | 1 | 108 | 9.1 | 72-134 | 30 | 10/09/2021 2247 |
| PFHpA | 58 | 14 | 74 | | 1 | 115 | 5.0 | 72-130 | 30 | 10/09/2021 2247 |
| PFHxA | 64 | 14 | 77 | | 1 | 89 | 1.0 | 72-129 | 30 | 10/09/2021 2247 |
| PFNA | 42 | 14 | 56 | | 1 | 103 | 3.6 | 69-130 | 30 | 10/09/2021 2247 |
| PFOA | 95 | 14 | 100 | N | 1 | 64 | 6.7 | 71-133 | 30 | 10/09/2021 2247 |
| PFPeA | 42 | 14 | 56 | | 1 | 106 | 0.40 | 72-129 | 30 | 10/09/2021 2247 |
| PFTeDA | ND | 14 | 13 | | 1 | 95 | 4.0 | 71-132 | 30 | 10/09/2021 2247 |
| PFTrDA | ND | 14 | 14 | | 1 | 104 | 2.5 | 65-144 | 30 | 10/09/2021 2247 |
| PFUdA | ND | 14 | 14 | | 1 | 104 | 0.72 | 69-133 | 30 | 10/09/2021 2247 |
| PFOS | 7100 | 13 | 7400 | N | 1 | 1750 | 2.2 | 65-140 | 30 | 10/09/2021 2247 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 100 | 50-150 |
| 13C2_6:2FTS | | 109 | 50-150 |
| 13C2_8:2FTS | | 80 | 50-150 |
| 13C2_PFDoA | | 74 | 50-150 |
| 13C2_PFTeDA | | 87 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 |
| 13C3_PFHxS | | 88 | 50-150 |
| 13C4_PFBA | | 96 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 |
| 13C8_PFOA | | 84 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MSD

**Sample ID:** WI18007-007MD
**Batch:** 18205
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/08/2021 1611

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 64 | 50-150 |
| 13C8_PFOSA | | 94 | 50-150 |
| 13C9_PFNA | | 63 | 50-150 |
| d5-EtFOSAA | | 92 | 50-150 |
| d-MeFOSA | | 79 | 50-150 |
| d3-MeFOSAA | | 90 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18329-001
**Batch:** 18329
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/11/2021 1143

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/12/2021 1342 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/12/2021 1342 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/12/2021 1342 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/12/2021 1342 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/12/2021 1342 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/12/2021 1342 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/12/2021 1342 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 92 | 50-150 |
| 13C2_6:2FTS | | 104 | 50-150 |
| 13C2_8:2FTS | | 92 | 50-150 |
| 13C2_PFDoA | | 85 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 |
| 13C3_PFBS | | 87 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 90 | 50-150 |
| 13C6_PFDA | | 89 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18329-001
**Batch:** 18329
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/11/2021 1143

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 92 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 |
| 13C9_PFNA | | 88 | 50-150 |
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 88 | 50-150 |
| d3-MeFOSAA | | 89 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18329-002
**Batch:** 18329
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/11/2021 1143

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 13 | | 1 | 87 | 67-138 | 10/12/2021 1352 |
| 6:2 FTS | 15 | 16 | | 1 | 108 | 64-140 | 10/12/2021 1352 |
| 4:2 FTS | 15 | 14 | | 1 | 96 | 63-143 | 10/12/2021 1352 |
| EtFOSAA | 16 | 15 | | 1 | 95 | 61-135 | 10/12/2021 1352 |
| MeFOSA | 16 | 17 | | 1 | 106 | 68-141 | 10/12/2021 1352 |
| MeFOSAA | 16 | 15 | | 1 | 96 | 65-136 | 10/12/2021 1352 |
| PFBS | 14 | 14 | | 1 | 97 | 72-130 | 10/12/2021 1352 |
| PFDS | 15 | 16 | | 1 | 101 | 53-142 | 10/12/2021 1352 |
| PFHpS | 15 | 15 | | 1 | 98 | 69-134 | 10/12/2021 1352 |
| PFNS | 15 | 17 | | 1 | 109 | 69-127 | 10/12/2021 1352 |
| PFOSA | 16 | 15 | | 1 | 92 | 67-137 | 10/12/2021 1352 |
| PFPeS | 15 | 14 | | 1 | 93 | 71-127 | 10/12/2021 1352 |
| PFHxS | 15 | 14 | | 1 | 97 | 68-131 | 10/12/2021 1352 |
| PFBA | 16 | 15 | | 1 | 96 | 73-129 | 10/12/2021 1352 |
| PFDA | 16 | 16 | | 1 | 97 | 71-129 | 10/12/2021 1352 |
| PFDoA | 16 | 15 | | 1 | 93 | 72-134 | 10/12/2021 1352 |
| PFHpA | 16 | 15 | | 1 | 95 | 72-130 | 10/12/2021 1352 |
| PFHxA | 16 | 15 | | 1 | 97 | 72-129 | 10/12/2021 1352 |
| PFNA | 16 | 15 | | 1 | 92 | 69-130 | 10/12/2021 1352 |
| PFOA | 16 | 15 | | 1 | 94 | 71-133 | 10/12/2021 1352 |
| PFPeA | 16 | 15 | | 1 | 94 | 72-129 | 10/12/2021 1352 |
| PFTeDA | 16 | 16 | | 1 | 100 | 71-132 | 10/12/2021 1352 |
| PFTrDA | 16 | 16 | | 1 | 99 | 65-144 | 10/12/2021 1352 |
| PFUdA | 16 | 16 | | 1 | 101 | 69-133 | 10/12/2021 1352 |
| PFOS | 15 | 16 | | 1 | 110 | 65-140 | 10/12/2021 1352 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 102 | 50-150 |
| 13C2_6:2FTS | | 103 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 |
| 13C2_PFDoA | | 90 | 50-150 |
| 13C2_PFTeDA | | 99 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 |
| 13C3_PFHxS | | 99 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 |
| 13C7_PFUdA | | 98 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18329-002
**Batch:** 18329
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/11/2021 1143

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 94 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 |
| 13C9_PFNA | | 94 | 50-150 |
| d5-EtFOSAA | | 101 | 50-150 |
| d-MeFOSA | | 94 | 50-150 |
| d3-MeFOSAA | | 96 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18442-001
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/14/2021 1451 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/14/2021 1451 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/14/2021 1451 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/14/2021 1451 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/14/2021 1451 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/14/2021 1451 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/14/2021 1451 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 106 | 50-150 |
| 13C2_6:2FTS | | 98 | 50-150 |
| 13C2_8:2FTS | | 87 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 80 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 |
| 13C4_PFHpA | | 94 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 89 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18442-001
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 |
| 13C9_PFNA | | 97 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 |
| d-MeFOSA | | 78 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18442-002
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 18 | | 1 | 117 | 67-138 | 10/14/2021 1502 |
| 6:2 FTS | 15 | 15 | | 1 | 96 | 64-140 | 10/14/2021 1502 |
| 4:2 FTS | 15 | 13 | | 1 | 87 | 63-143 | 10/14/2021 1502 |
| EtFOSAA | 16 | 17 | | 1 | 105 | 61-135 | 10/14/2021 1502 |
| MeFOSA | 16 | 15 | | 1 | 94 | 68-141 | 10/14/2021 1502 |
| MeFOSAA | 16 | 16 | | 1 | 99 | 65-136 | 10/14/2021 1502 |
| PFBS | 14 | 14 | | 1 | 99 | 72-130 | 10/14/2021 1502 |
| PFDS | 15 | 13 | | 1 | 87 | 53-142 | 10/14/2021 1502 |
| PFHpS | 15 | 14 | | 1 | 93 | 69-134 | 10/14/2021 1502 |
| PFNS | 15 | 15 | | 1 | 95 | 69-127 | 10/14/2021 1502 |
| PFOSA | 16 | 14 | | 1 | 89 | 67-137 | 10/14/2021 1502 |
| PFPeS | 15 | 14 | | 1 | 91 | 71-127 | 10/14/2021 1502 |
| PFHxS | 15 | 14 | | 1 | 94 | 68-131 | 10/14/2021 1502 |
| PFBA | 16 | 15 | | 1 | 96 | 73-129 | 10/14/2021 1502 |
| PFDA | 16 | 16 | | 1 | 100 | 71-129 | 10/14/2021 1502 |
| PFDoA | 16 | 15 | | 1 | 96 | 72-134 | 10/14/2021 1502 |
| PFHpA | 16 | 16 | | 1 | 101 | 72-130 | 10/14/2021 1502 |
| PFHxA | 16 | 15 | | 1 | 95 | 72-129 | 10/14/2021 1502 |
| PFNA | 16 | 15 | | 1 | 96 | 69-130 | 10/14/2021 1502 |
| PFOA | 16 | 15 | | 1 | 96 | 71-133 | 10/14/2021 1502 |
| PFPeA | 16 | 16 | | 1 | 98 | 72-129 | 10/14/2021 1502 |
| PFTeDA | 16 | 16 | | 1 | 101 | 71-132 | 10/14/2021 1502 |
| PFTrDA | 16 | 15 | | 1 | 96 | 65-144 | 10/14/2021 1502 |
| PFUdA | 16 | 18 | | 1 | 111 | 69-133 | 10/14/2021 1502 |
| PFOS | 15 | 14 | | 1 | 97 | 65-140 | 10/14/2021 1502 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 101 | 50-150 |
| 13C2_6:2FTS | | 90 | 50-150 |
| 13C2_8:2FTS | | 80 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 |
| 13C4_PFBA | | 90 | 50-150 |
| 13C4_PFHpA | | 86 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 |
| 13C6_PFDA | | 86 | 50-150 |
| 13C7_PFUdA | | 75 | 50-150 |
| 13C8_PFOA | | 89 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18442-002
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 85 | 50-150 |
| 13C9_PFNA | | 90 | 50-150 |
| d5-EtFOSAA | | 86 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MS

**Sample ID:** WI18007-014MS
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | 14 | 14 | | 1 | 106 | 67-138 | 10/14/2021 1616 |
| 6:2 FTS | ND | 13 | 11 | | 1 | 85 | 64-140 | 10/14/2021 1616 |
| 4:2 FTS | ND | 13 | 13 | | 1 | 98 | 63-143 | 10/14/2021 1616 |
| EtFOSAA | ND | 14 | 13 | | 1 | 94 | 61-135 | 10/14/2021 1616 |
| MeFOSA | ND | 14 | 17 | | 1 | 123 | 68-141 | 10/14/2021 1616 |
| MeFOSAA | ND | 14 | 14 | | 1 | 101 | 65-136 | 10/14/2021 1616 |
| PFBS | ND | 12 | 12 | | 1 | 94 | 72-130 | 10/14/2021 1616 |
| PFDS | ND | 14 | 14 | | 1 | 103 | 53-142 | 10/14/2021 1616 |
| PFHpS | ND | 13 | 13 | | 1 | 94 | 69-134 | 10/14/2021 1616 |
| PFNS | ND | 14 | 15 | | 1 | 113 | 69-127 | 10/14/2021 1616 |
| PFOSA | ND | 14 | 14 | | 1 | 97 | 67-137 | 10/14/2021 1616 |
| PFPeS | ND | 13 | 12 | | 1 | 92 | 71-127 | 10/14/2021 1616 |
| PFHxS | ND | 13 | 12 | | 1 | 97 | 68-131 | 10/14/2021 1616 |
| PFBA | ND | 14 | 14 | | 1 | 97 | 73-129 | 10/14/2021 1616 |
| PFDA | ND | 14 | 14 | | 1 | 96 | 71-129 | 10/14/2021 1616 |
| PFDoA | ND | 14 | 14 | | 1 | 97 | 72-134 | 10/14/2021 1616 |
| PFHpA | ND | 14 | 13 | | 1 | 92 | 72-130 | 10/14/2021 1616 |
| PFHxA | ND | 14 | 13 | | 1 | 93 | 72-129 | 10/14/2021 1616 |
| PFNA | ND | 14 | 14 | | 1 | 99 | 69-130 | 10/14/2021 1616 |
| PFOA | ND | 14 | 14 | | 1 | 97 | 71-133 | 10/14/2021 1616 |
| PFPeA | ND | 14 | 14 | | 1 | 98 | 72-129 | 10/14/2021 1616 |
| PFTeDA | ND | 14 | 15 | | 1 | 103 | 71-132 | 10/14/2021 1616 |
| PFTrDA | ND | 14 | 14 | | 1 | 98 | 65-144 | 10/14/2021 1616 |
| PFUdA | ND | 14 | 15 | | 1 | 109 | 69-133 | 10/14/2021 1616 |
| PFOS | ND | 13 | 13 | | 1 | 98 | 65-140 | 10/14/2021 1616 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 |
| 13C2_6:2FTS | | 131 | 50-150 |
| 13C2_8:2FTS | | 89 | 50-150 |
| 13C2_PFDoA | | 92 | 50-150 |
| 13C2_PFTeDA | | 95 | 50-150 |
| 13C3_PFBS | | 105 | 50-150 |
| 13C3_PFHxS | | 104 | 50-150 |
| 13C4_PFBA | | 99 | 50-150 |
| 13C4_PFHpA | | 102 | 50-150 |
| 13C5_PFHxA | | 103 | 50-150 |
| 13C5_PFPeA | | 98 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 |
| 13C8_PFOA | | 105 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MS

**Sample ID:** WI18007-014MS
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 100 | 50-150 |
| 13C8_PFOSA | | 105 | 50-150 |
| 13C9_PFNA | | 106 | 50-150 |
| d5-EtFOSAA | | 107 | 50-150 |
| d-MeFOSA | | 71 | 50-150 |
| d3-MeFOSAA | | 108 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - Duplicate

**Sample ID:** WI18007-015DU
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| 6:2 FTS | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| 4:2 FTS | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| EtFOSAA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| MeFOSA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| MeFOSAA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFBS | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFHpS | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFNS | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFOSA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFPeS | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFHxS | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFBA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFDA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFHpA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFHxA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFNA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFOA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFPeA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFUdA | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |
| PFOS | ND | ND | | 1 | 0.00 | 20 | 10/14/2021 1637 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 101 | 50-150 |
| 13C2_6:2FTS | | 136 | 50-150 |
| 13C2_8:2FTS | | 79 | 50-150 |
| 13C2_PFDoA | | 76 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 |
| 13C3_PFBS | | 96 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 |
| 13C4_PFBA | | 94 | 50-150 |
| 13C4_PFHpA | | 90 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 89 | 50-150 |
| 13C7_PFUdA | | 79 | 50-150 |
| 13C8_PFOA | | 98 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - Duplicate

**Sample ID:** WI18007-015DU
**Batch:** 18442
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/12/2021 1201

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 86 | 50-150 |
| 13C8_PFOSA | | 87 | 50-150 |
| 13C9_PFNA | | 95 | 50-150 |
| d5-EtFOSAA | | 87 | 50-150 |
| d-MeFOSA | | 76 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18749-001
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/15/2021 1309 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/15/2021 1309 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/15/2021 1309 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/15/2021 1309 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/15/2021 1309 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/15/2021 1309 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/15/2021 1309 |
| **PFOS** | **1.5** | **J** | **1** | **4.0** | 2.0 | **1.0** | **ng/L** | **10/15/2021 1309** |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 91 | 50-150 |
| 13C2_6:2FTS | | 94 | 50-150 |
| 13C2_8:2FTS | | 82 | 50-150 |
| 13C2_PFDoA | | 85 | 50-150 |
| 13C2_PFTeDA | | 87 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 |
| 13C3_PFHxS | | 87 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 |
| 13C5_PFPeA | | 91 | 50-150 |
| 13C6_PFDA | | 86 | 50-150 |
| 13C7_PFUdA | | 100 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MB

**Sample ID:** WQ18749-001
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 86 | 50-150 |
| 13C8_PFOSA | | 91 | 50-150 |
| 13C9_PFNA | | 101 | 50-150 |
| d5-EtFOSAA | | 87 | 50-150 |
| d-MeFOSA | | 67 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18749-002
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 15 | | 1 | 99 | 67-138 | 10/15/2021 1320 |
| 6:2 FTS | 15 | 16 | | 1 | 102 | 64-140 | 10/15/2021 1320 |
| 4:2 FTS | 15 | 15 | | 1 | 100 | 63-143 | 10/15/2021 1320 |
| EtFOSAA | 16 | 15 | | 1 | 96 | 61-135 | 10/15/2021 1320 |
| MeFOSA | 16 | 18 | | 1 | 113 | 68-141 | 10/15/2021 1320 |
| MeFOSAA | 16 | 16 | | 1 | 101 | 65-136 | 10/15/2021 1320 |
| PFBS | 14 | 13 | | 1 | 94 | 72-130 | 10/15/2021 1320 |
| PFDS | 15 | 14 | | 1 | 91 | 53-142 | 10/15/2021 1320 |
| PFHpS | 15 | 15 | | 1 | 97 | 69-134 | 10/15/2021 1320 |
| PFNS | 15 | 15 | | 1 | 95 | 69-127 | 10/15/2021 1320 |
| PFOSA | 16 | 13 | | 1 | 84 | 67-137 | 10/15/2021 1320 |
| PFPeS | 15 | 15 | | 1 | 98 | 71-127 | 10/15/2021 1320 |
| PFHxS | 15 | 14 | | 1 | 94 | 68-131 | 10/15/2021 1320 |
| PFBA | 16 | 15 | | 1 | 96 | 73-129 | 10/15/2021 1320 |
| PFDA | 16 | 16 | | 1 | 97 | 71-129 | 10/15/2021 1320 |
| PFDoA | 16 | 16 | | 1 | 101 | 72-134 | 10/15/2021 1320 |
| PFHpA | 16 | 16 | | 1 | 100 | 72-130 | 10/15/2021 1320 |
| PFHxA | 16 | 15 | | 1 | 92 | 72-129 | 10/15/2021 1320 |
| PFNA | 16 | 16 | | 1 | 103 | 69-130 | 10/15/2021 1320 |
| PFOA | 16 | 15 | | 1 | 95 | 71-133 | 10/15/2021 1320 |
| PFPeA | 16 | 16 | | 1 | 100 | 72-129 | 10/15/2021 1320 |
| PFTeDA | 16 | 17 | | 1 | 103 | 71-132 | 10/15/2021 1320 |
| PFTrDA | 16 | 15 | | 1 | 95 | 65-144 | 10/15/2021 1320 |
| PFUdA | 16 | 16 | | 1 | 103 | 69-133 | 10/15/2021 1320 |
| PFOS | 15 | 13 | | 1 | 89 | 65-140 | 10/15/2021 1320 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 89 | 50-150 |
| 13C2_6:2FTS | | 95 | 50-150 |
| 13C2_8:2FTS | | 78 | 50-150 |
| 13C2_PFDoA | | 81 | 50-150 |
| 13C2_PFTeDA | | 86 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 |
| 13C5_PFHxA | | 92 | 50-150 |
| 13C5_PFPeA | | 87 | 50-150 |
| 13C6_PFDA | | 85 | 50-150 |
| 13C7_PFUdA | | 95 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - LCS

**Sample ID:** WQ18749-002
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 85 | 50-150 |
| 13C8_PFOSA | | 90 | 50-150 |
| 13C9_PFNA | | 95 | 50-150 |
| d5-EtFOSAA | | 81 | 50-150 |
| d-MeFOSA | | 56 | 50-150 |
| d3-MeFOSAA | | 85 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MS

**Sample ID:** WI18007-007MS
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 56 | 13 | 64 | N | 1 | 64 | 67-138 | 10/16/2021 1637 |
| 6:2 FTS | 30 | 13 | 47 | | 1 | 130 | 64-140 | 10/16/2021 1637 |
| 4:2 FTS | ND | 13 | 15 | | 1 | 112 | 63-143 | 10/16/2021 1637 |
| EtFOSAA | ND | 14 | 13 | | 1 | 97 | 61-135 | 10/16/2021 1637 |
| MeFOSA | ND | 14 | 15 | | 1 | 107 | 68-141 | 10/16/2021 1637 |
| MeFOSAA | ND | 14 | 13 | | 1 | 95 | 65-136 | 10/16/2021 1637 |
| PFBS | 7.1 | 12 | 20 | | 1 | 105 | 72-130 | 10/16/2021 1637 |
| PFDS | ND | 13 | 18 | | 1 | 132 | 53-142 | 10/16/2021 1637 |
| PFHpS | 34 | 13 | 49 | | 1 | 112 | 69-134 | 10/16/2021 1637 |
| PFNS | ND | 13 | 18 | N | 1 | 137 | 69-127 | 10/16/2021 1637 |
| PFOSA | ND | 14 | 16 | | 1 | 112 | 67-137 | 10/16/2021 1637 |
| PFPeS | 15 | 13 | 29 | | 1 | 107 | 71-127 | 10/16/2021 1637 |
| PFHxS | 490 | 13 | 510 | N | 1 | 170 | 68-131 | 10/16/2021 1637 |
| PFBA | 22 | 14 | 35 | | 1 | 97 | 73-129 | 10/16/2021 1637 |
| PFDA | ND | 14 | 15 | | 1 | 106 | 71-129 | 10/16/2021 1637 |
| PFDoA | ND | 14 | 14 | | 1 | 103 | 72-134 | 10/16/2021 1637 |
| PFHpA | 60 | 14 | 72 | | 1 | 86 | 72-130 | 10/16/2021 1637 |
| PFHxA | 60 | 14 | 73 | | 1 | 92 | 72-129 | 10/16/2021 1637 |
| PFNA | 46 | 14 | 58 | | 1 | 92 | 69-130 | 10/16/2021 1637 |
| PFOA | 91 | 14 | 100 | | 1 | 82 | 71-133 | 10/16/2021 1637 |
| PFPeA | 42 | 14 | 57 | | 1 | 110 | 72-129 | 10/16/2021 1637 |
| PFTeDA | ND | 14 | 14 | | 1 | 100 | 71-132 | 10/16/2021 1637 |
| PFTrDA | ND | 14 | 13 | | 1 | 94 | 65-144 | 10/16/2021 1637 |
| PFUdA | ND | 14 | 13 | | 1 | 92 | 69-133 | 10/16/2021 1637 |
| PFOS | 6900 | 13 | 6900 | N | 1 | -496 | 65-140 | 10/16/2021 1637 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 125 | 50-150 |
| 13C2_6:2FTS | | 108 | 50-150 |
| 13C2_8:2FTS | | 106 | 50-150 |
| 13C2_PFDoA | | 96 | 50-150 |
| 13C2_PFTeDA | | 99 | 50-150 |
| 13C3_PFBS | | 105 | 50-150 |
| 13C3_PFHxS | | 112 | 50-150 |
| 13C4_PFBA | | 114 | 50-150 |
| 13C4_PFHpA | | 102 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 |
| 13C5_PFPeA | | 104 | 50-150 |
| 13C6_PFDA | | 105 | 50-150 |
| 13C7_PFUdA | | 104 | 50-150 |
| 13C8_PFOA | | 115 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MS

**Sample ID:** WI18007-007MS
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 68 | 50-150 |
| 13C8_PFOSA | | 106 | 50-150 |
| 13C9_PFNA | | 74 | 50-150 |
| d5-EtFOSAA | | 100 | 50-150 |
| d-MeFOSA | | 98 | 50-150 |
| d3-MeFOSAA | | 108 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# PFAS by LC/MS/MS - MSD

**Sample ID:** WI18007-007MD
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 56 | 13 | 68 | | 1 | 92 | 5.3 | 67-138 | 30 | 10/16/2021 1648 |
| 6:2 FTS | 30 | 13 | 47 | | 1 | 135 | 0.70 | 64-140 | 30 | 10/16/2021 1648 |
| 4:2 FTS | ND | 13 | 14 | | 1 | 106 | 7.3 | 63-143 | 30 | 10/16/2021 1648 |
| EtFOSAA | ND | 14 | 12 | | 1 | 91 | 8.3 | 61-135 | 30 | 10/16/2021 1648 |
| MeFOSA | ND | 14 | 16 | | 1 | 113 | 4.1 | 68-141 | 30 | 10/16/2021 1648 |
| MeFOSAA | ND | 14 | 14 | | 1 | 103 | 7.0 | 65-136 | 30 | 10/16/2021 1648 |
| PFBS | 7.1 | 12 | 18 | | 1 | 87 | 13 | 72-130 | 30 | 10/16/2021 1648 |
| PFDS | ND | 13 | 16 | | 1 | 123 | 9.3 | 53-142 | 30 | 10/16/2021 1648 |
| PFHpS | 34 | 13 | 52 | N | 1 | 135 | 5.4 | 69-134 | 30 | 10/16/2021 1648 |
| PFNS | ND | 13 | 18 | N | 1 | 139 | 0.0055 | 69-127 | 30 | 10/16/2021 1648 |
| PFOSA | ND | 14 | 15 | | 1 | 110 | 3.4 | 67-137 | 30 | 10/16/2021 1648 |
| PFPeS | 15 | 13 | 26 | | 1 | 83 | 12 | 71-127 | 30 | 10/16/2021 1648 |
| PFHxS | 490 | 12 | 520 | N | 1 | 260 | 2.1 | 68-131 | 30 | 10/16/2021 1648 |
| PFBA | 22 | 14 | 35 | | 1 | 102 | 1.1 | 73-129 | 30 | 10/16/2021 1648 |
| PFDA | ND | 14 | 14 | | 1 | 105 | 2.0 | 71-129 | 30 | 10/16/2021 1648 |
| PFDoA | ND | 14 | 14 | | 1 | 105 | 0.42 | 72-134 | 30 | 10/16/2021 1648 |
| PFHpA | 60 | 14 | 83 | N | 1 | 167 | 14 | 72-130 | 30 | 10/16/2021 1648 |
| PFHxA | 60 | 14 | 75 | | 1 | 105 | 2.2 | 72-129 | 30 | 10/16/2021 1648 |
| PFNA | 46 | 14 | 58 | | 1 | 91 | 0.59 | 69-130 | 30 | 10/16/2021 1648 |
| PFOA | 91 | 14 | 110 | | 1 | 131 | 6.2 | 71-133 | 30 | 10/16/2021 1648 |
| PFPeA | 42 | 14 | 54 | | 1 | 92 | 4.9 | 72-129 | 30 | 10/16/2021 1648 |
| PFTeDA | ND | 14 | 15 | | 1 | 112 | 9.7 | 71-132 | 30 | 10/16/2021 1648 |
| PFTrDA | ND | 14 | 14 | | 1 | 105 | 8.5 | 65-144 | 30 | 10/16/2021 1648 |
| PFUdA | ND | 14 | 14 | | 1 | 105 | 11 | 69-133 | 30 | 10/16/2021 1648 |
| PFOS | 6900 | 13 | 6900 | N | 1 | -326 | 0.33 | 65-140 | 30 | 10/16/2021 1648 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 118 | 50-150 |
| 13C2_6:2FTS | | 104 | 50-150 |
| 13C2_8:2FTS | | 90 | 50-150 |
| 13C2_PFDoA | | 81 | 50-150 |
| 13C2_PFTeDA | | 86 | 50-150 |
| 13C3_PFBS | | 103 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 104 | 50-150 |
| 13C4_PFHpA | | 80 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 |
| 13C5_PFPeA | | 99 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 |
| 13C8_PFOA | | 101 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MSD

**Sample ID:** WI18007-007MD
**Batch:** 18749
**Analytical Method:** PFAS by ID SOP QSM B-15

**Matrix:** Aqueous
**Prep Method:** SOP SPE
**Prep Date:** 10/14/2021 1149

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 64 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 |
| 13C9_PFNA | | 68 | 50-150 |
| d5-EtFOSAA | | 98 | 50-150 |
| d-MeFOSA | | 79 | 50-150 |
| d3-MeFOSAA | | 90 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

**Note: Calculations are performed before rounding to avoid round-off errors in calculated results**

# Chain of Custody
# and
# Miscellaneous Documents

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 124648

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kirsten Hasbrouck, Patrick Cumy | Telephone No. / E-mail: 281-554-5092 / Kirsten.Hasbrouck@arcadis.com; 734-355-2809 / Patrick.Cumy@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x [signature] | Analysis (Attach list if more space is needed) | Page 1 of |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | |
| Project Name: ESTCP Vertebrae | | | |
| Project No.: 30027244 | P.O. No. | | |

PFAS via Method 537 (mod.) w/ isotope dilution

WI18007
KES2

| Sample ID / Description (Containers for each sample may be combined on one line) | Collection Date(s) | Collection Time (Military) | Grab/Composite | Matrix: Aqueous | Solid | Other | No. of Containers by Preservative Type: Unpres. | H2SO4 | HNO3 | HCl | NaOH | ZnAc/NaOH | Other | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VAP-VRTB-02_36-40 | 9/13/21 | 1345 | G | X | | | 2 | | | | | | | |
| VAP-VRTB-01_34.5-38.5 | 9/13/21 | 1530 | G | X | | | 2 | | | | | | | |
| VAP-VRTB-01_29.5-33.5 | 9/13/21 | 1615 | G | X | | | 2 | | | | | | | |
| VAP-VRTB-01_25-29 | 9/13/21 | 1645 | G | X | | | 2 | | | | | | | |
| VAP-VRTB-DUP-01 | 9/13/21 | — | G | X | | | 2 | | | | | | | |
| VAP-VRTB-01_20-24 | 9/13/21 | 1715 | G | X | | | 2 | | | | | | | |
| VAP-VRTB-01_15-19 | 9/13/21 | 1750 | G | X | | | 6 | | | | | | | MS/MSD |
| VRTB-EB01-(091421) | 9/14/21 | 0900 | G | X | | | 2 | | | | | | | |
| VAP-VRTB-05_36-40 | 9/14/21 | 1040 | G | X | | | 2 | | | | | | | |
| VAP-VRTB-05_31-35 | 9/14/21 | 1120 | G | X | | | 2 | | | | | | | |

| | | | |
|---|---|---|---|
| Turn Around Time Required (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify) | Sample Disposal: ☐ Return to Client X Disposal by Lab | Possible Hazard Identification: X Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown | QC Requirements (Specify) |

| | | | | | |
|---|---|---|---|---|---|
| 1. Relinquished by: [signature] / Austin Westhuis | Date: 9/16/21 | Time: 1750 | 1. Received by: [signature] | Date: time 1750 | Time: date 9/16/21 |
| 2. Relinquished by: [signature] | Date: 9/17/21 | Time: 1030 | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: Fedex | Date: 9/18/21 | Time: 0930 | 4. Laboratory received by: [signature] | Date: 9/18/21 | Time: 0930 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on Ice (Circle): (Yes) No Ice Pack; Receipt Temp: 2.4 °C; Temp Blank: Y N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy * Report EGLE 28 Compounds * Document Number: ME003N2-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 124649

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Patrick Curry | Telephone No. / E-mail: 231-533-5092 / Kristen.Hasbrouck@arcadis.com, 734-355-2864 / Patrick.Curry@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x | Analysis (Attach list if more space is needed) | Page 2 of ___ |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | |
| Project Name: ESTCP Vertebrae | | | |
| Project No.: 300271244 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab/Composite | Matrix: Aqueous | Matrix: Solid | Matrix: Non-Aqueous | No. of Containers by Preservative Type: Unpres. | HNO3 | HCl | NaOH | Na2S2O3 | Foat Pellets | PFAS via method 537 mod. w/ isotope dilution per QSM 5.2 | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VAP-VRTB-05_26-30 | 9/14/21 | 1155 | G | X | | | 2 | | | | | | X | |
| VAP-VRTB-05_21.5-25.5 | 9/14/21 | 1225 | G | X | | | 2 | | | | | | X | |
| VAP-VRTB-05_16.5-20.5 | 9/14/21 | 1245 | G | X | | | 2 | | | | | | X | |
| VRTB-EB02-(091621) | 9/16/21 | 1110 | G | X | | | 2 | | | | | | X | |
| VRTB-EB03-(091621) | 9/16/21 | 1215 | G | X | | | 2 | | | | | | X | |
| VRTB-EB04-(091621) | 9/16/21 | 1230 | G | X | | | 2 | | | | | | X | |
| VRTB-WB01-(091621) | 9/16/21 | 1400 | G | X | | | 2 | | | | | | X | |

WI18007
KES2

Turn Around Time Required (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client X Disposal by Lab

Possible Hazard Identification: X Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

| | Date | Time |
|---|---|---|
| 1. Relinquished by: Austin Westhuis | 9/16/21 | 1758 |
| 2. Relinquished by: | 9/17/21 | 1630 |
| 3. Relinquished by: | Date | Time |
| 4. Relinquished by: Fedex | 9/18/21 | 0930 |

| | Date | Time |
|---|---|---|
| 1. Received by: | 9/16/21 | 1758 |
| 2. Received by: | Date | Time |
| 3. Received by: | Date | Time |
| 4. Laboratory received by: | 9/18/21 | 0930 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle): (Yes) No Ice Pack
Receipt Temp: 2-4 °C
Temp Blank: Y / N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s), PINK-Field/Client Copy * Report EGLE 28 Compounds *

Document Number: ME005N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised: 9/29/2020


# Sample Receipt Checklist (SRC)

Client: ARCADIS  Cooler Inspected by/date: JRG2 / 09/18/2021  Lot #: W118697

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

| | | | |
|---|---|---|---|
| ☐ Yes | ☑ No | | 1. Were custody seals present on the cooler? |
| ☐ Yes | ☐ No | ☑ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: NA

2.4 / 2.4 °C  NA / NA °C  NA / NA °C  NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles  IR Gun ID: 5  IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☐ Yes | ☐ No | ☑ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☐ Yes | ☑ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼" or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc...) correctly transcribed from the COC into the comment section in LIMS? |
| ☐ Yes | ☑ No | | 21. Was the quote number listed on the container label? If yes, Quote # NA |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA _____ were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA _____ were received with bubbles >6 mm in diameter.

Samples(s) NA _____ were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2  Date: 09/18/2021

Comments:

# Appendix C-2 Soil Samples

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP GAAF

Project Number: 30027244

Lot Number:**WI18011**

Date Completed:11/17/2021

11/17/2021 5:10 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: WI18011

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: WI18011

Project Name: ESTCP GAAF

Project Number: 30027244

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | SB-VRTB-03_10.5-11 | Solid | 09/14/2021 1215 | 09/18/2021 |
| 002 | SB-VRTB-03_11.5-12 | Solid | 09/14/2021 1220 | 09/18/2021 |
| 003 | SB-VRTB-03_12.5-13 | Solid | 09/14/2021 1225 | 09/18/2021 |
| 004 | SB-VRTB-03_13-13.5 | Solid | 09/14/2021 1235 | 09/18/2021 |
| 005 | SB-VRTB-03_13.75-14 | Solid | 09/14/2021 1240 | 09/18/2021 |
| 006 | SB-VRTB-03_14-14.25 | Solid | 09/14/2021 1243 | 09/18/2021 |
| 007 | SB-VRTB-03_14.25-14.5 | Solid | 09/14/2021 1245 | 09/18/2021 |
| 008 | SB-VRTB-03_14.75-15 | Solid | 09/14/2021 1250 | 09/18/2021 |
| 009 | SB-VRTB-03_15.25-15.5 | Solid | 09/14/2021 1415 | 09/18/2021 |
| 010 | SB-VRTB-03_15.75-16 | Solid | 09/14/2021 1420 | 09/18/2021 |
| 011 | SB-VRTB-03_16.25-16.5 | Solid | 09/14/2021 1425 | 09/18/2021 |
| 012 | SB-VRTB-03_16.5-17 | Solid | 09/14/2021 1430 | 09/18/2021 |
| 013 | SB-VRTB-03_17-17.5 | Solid | 09/14/2021 1440 | 09/18/2021 |
| 014 | SB-VRTB-03_18-18.5 | Solid | 09/14/2021 1445 | 09/18/2021 |
| 015 | SB-VRTB-03_19-19.5 | Solid | 09/14/2021 1448 | 09/18/2021 |
| 016 | SB-VRTB-03_20.5-21 | Solid | 09/14/2021 1550 | 09/18/2021 |
| 017 | SB-VRTB-03_22.5-23 | Solid | 09/14/2021 1555 | 09/18/2021 |
| 018 | SB-VRTB-03_24-24.5 | Solid | 09/14/2021 1600 | 09/18/2021 |
| 019 | SB-VRTB-03_26-26.5 | Solid | 09/15/2021 0940 | 09/18/2021 |
| 020 | SB-VRTB-03_27-27.5 | Solid | 09/15/2021 0950 | 09/18/2021 |
| 021 | SB-VRTB-03_30-30.5 | Solid | 09/15/2021 1045 | 09/18/2021 |
| 022 | SB-VRTB-03_32-32.5 | Solid | 09/15/2021 1048 | 09/18/2021 |
| 023 | SB-VRTB-03_34-34.5 | Solid | 09/15/2021 1052 | 09/18/2021 |
| 024 | SB-VRTB-03_35-35.5 | Solid | 09/15/2021 1146 | 09/18/2021 |
| 025 | SB-VRTB-03_36-36.5 | Solid | 09/15/2021 1142 | 09/18/2021 |
| 026 | SB-VRTB-DUP-01 | Solid | 09/15/2021 | 09/18/2021 |
| 027 | SB-VRTB-DUP-02 | Solid | 09/15/2021 | 09/18/2021 |

(27 samples)

## Detection Summary

## Arcadis U.S., Inc.

Lot Number: WI18011

Project Name: ESTCP GAAF

Project Number: 30027244

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | SB-VRTB-03_10.5-11 | Solid | PFBA | PFAS by ID | 0.22 | J | ug/kg | 5 |
| 001 | SB-VRTB-03_10.5-11 | Solid | PFOS | PFAS by ID | 0.43 | J | ug/kg | 5 |
| 009 | SB-VRTB-03_15.25-15.5 | Solid | PFOA | PFAS by ID | 0.20 | J | ug/kg | 17 |
| 009 | SB-VRTB-03_15.25-15.5 | Solid | PFOS | PFAS by ID | 0.48 | J | ug/kg | 17 |
| 010 | SB-VRTB-03_15.75-16 | Solid | PFOS | PFAS by ID | 0.94 | J | ug/kg | 19 |
| 011 | SB-VRTB-03_16.25-16.5 | Solid | PFOS | PFAS by ID | 3.1 | | ug/kg | 21 |
| 013 | SB-VRTB-03_17-17.5 | Solid | PFHxS | PFAS by ID | 0.24 | J | ug/kg | 23 |
| 013 | SB-VRTB-03_17-17.5 | Solid | PFOS | PFAS by ID | 7.1 | | ug/kg | 23 |
| 014 | SB-VRTB-03_18-18.5 | Solid | PFHxS | PFAS by ID | 0.37 | J | ug/kg | 25 |
| 014 | SB-VRTB-03_18-18.5 | Solid | PFOS | PFAS by ID | 41 | | ug/kg | 25 |
| 016 | SB-VRTB-03_20.5-21 | Solid | PFOS | PFAS by ID | 1.4 | | ug/kg | 27 |
| 018 | SB-VRTB-03_24-24.5 | Solid | PFHxS | PFAS by ID | 0.28 | J | ug/kg | 29 |
| 018 | SB-VRTB-03_24-24.5 | Solid | PFOS | PFAS by ID | 10 | | ug/kg | 29 |
| 022 | SB-VRTB-03_32-32.5 | Solid | PFHxS | PFAS by ID | 0.21 | J | ug/kg | 33 |
| 022 | SB-VRTB-03_32-32.5 | Solid | PFOS | PFAS by ID | 5.8 | S | ug/kg | 33 |

(15 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-001
Description: SB-VRTB-03_10.5-11 | Matrix: Solid
Date Sampled: 09/14/2021 1215 | Project Name: ESTCP GAAF | % Solids: 95.8 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/20/2021 1813 | JJG | 09/19/2021 1515 | 15796 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 1853 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.22 | J | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.43 | J | 1.0 | 0.50 | 0.20 | ug/kg | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 59 | 50-150 | | 69 | 50-150 |
| 13C2_6:2FTS | | 61 | 50-150 | | 81 | 50-150 |
| 13C2_8:2FTS | | 65 | 50-150 | | 73 | 50-150 |
| 13C2_PFDoA | | 59 | 50-150 | | 70 | 50-150 |
| 13C2_PFTeDA | | 65 | 50-150 | | 72 | 50-150 |
| 13C3_PFBS | | 61 | 50-150 | | 74 | 50-150 |
| 13C3_PFHxS | | 67 | 50-150 | | 79 | 50-150 |
| 13C4_PFBA | | 59 | 50-150 | | 72 | 50-150 |
| 13C4_PFHpA | | 61 | 50-150 | | 72 | 50-150 |
| 13C5_PFHxA | | 61 | 50-150 | | 68 | 50-150 |
| 13C5_PFPeA | | 60 | 50-150 | | 73 | 50-150 |
| 13C6_PFDA | | 61 | 50-150 | | 74 | 50-150 |
| 13C7_PFUdA | | 66 | 50-150 | | 75 | 50-150 |
| 13C8_PFOA | | 61 | 50-150 | | 75 | 50-150 |
| 13C8_PFOS | | 65 | 50-150 | | 74 | 50-150 |
| 13C8_PFOSA | | 61 | 50-150 | | 80 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-001 |
| Description: SB-VRTB-03_10.5-11 | | Matrix: Solid |
| Date Sampled: 09/14/2021 1215 | Project Name: ESTCP GAAF | % Solids: 95.8 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 62 | 50-150 | | 70 | 50-150 |
| d5-EtFOSAA | | 59 | 50-150 | | 56 | 50-150 |
| d-MeFOSA | | 57 | 50-150 | | 73 | 50-150 |
| d3-MeFOSAA | | 58 | 50-150 | | 59 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-002
Description: SB-VRTB-03_11.5-12 | Matrix: Solid
Date Sampled: 09/14/2021 1220 | Project Name: ESTCP GAAF | % Solids: 97.6 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/20/2021 1824 | JJG | 09/19/2021 1515 | 15796 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 1903 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 89 | 50-150 | | 85 | 50-150 |
| 13C2_6:2FTS | | 75 | 50-150 | | 84 | 50-150 |
| 13C2_8:2FTS | | 86 | 50-150 | | 82 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 | | 77 | 50-150 |
| 13C2_PFTeDA | | 88 | 50-150 | | 81 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 | | 90 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 | | 95 | 50-150 |
| 13C4_PFBA | | 86 | 50-150 | | 87 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 | | 83 | 50-150 |
| 13C5_PFHxA | | 88 | 50-150 | | 81 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | | 87 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 | | 87 | 50-150 |
| 13C7_PFUdA | | 92 | 50-150 | | 82 | 50-150 |
| 13C8_PFOA | | 75 | 50-150 | | 83 | 50-150 |
| 13C8_PFOS | | 89 | 50-150 | | 85 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 | | 89 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-002 | |
| Description: SB-VRTB-03_11.5-12 | | Matrix: Solid | |
| Date Sampled: 09/14/2021 1220 | Project Name: ESTCP GAAF | % Solids: 97.6 | 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | | 87 | 50-150 |
| d5-EtFOSAA | | 92 | 50-150 | | 81 | 50-150 |
| d-MeFOSA | | 93 | 50-150 | | 87 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 | | 85 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-003
Description: SB-VRTB-03_12.5-13 | Matrix: Solid
Date Sampled: 09/14/2021 1225 | Project Name: ESTCP GAAF | % Solids: 99.2 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/20/2021 1949 | JJG | 09/19/2021 1515 | 15796 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 1914 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 0.85 | U | 1.7 | 0.85 | 0.43 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.48 | ug/kg | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 0.85 | U | 1.7 | 0.85 | 0.43 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 0.85 | U | 1.7 | 0.85 | 0.43 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 0.85 | U | 1.7 | 0.85 | 0.43 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 0.85 | U | 1.7 | 0.85 | 0.43 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.43 | U | 0.86 | 0.43 | 0.17 | ug/kg | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 | | 91 | 50-150 |
| 13C2_6:2FTS | | 90 | 50-150 | | 90 | 50-150 |
| 13C2_8:2FTS | | 88 | 50-150 | | 82 | 50-150 |
| 13C2_PFDoA | | 91 | 50-150 | | 77 | 50-150 |
| 13C2_PFTeDA | | 91 | 50-150 | | 82 | 50-150 |
| 13C3_PFBS | | 88 | 50-150 | | 85 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 | | 91 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 | | 87 | 50-150 |
| 13C4_PFHpA | | 90 | 50-150 | | 90 | 50-150 |
| 13C5_PFHxA | | 92 | 50-150 | | 83 | 50-150 |
| 13C5_PFPeA | | 91 | 50-150 | | 86 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 | | 83 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 | | 85 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 | | 86 | 50-150 |
| 13C8_PFOS | | 100 | 50-150 | | 87 | 50-150 |
| 13C8_PFOSA | | 95 | 50-150 | | 94 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-003 | |
| Description: SB-VRTB-03_12.5-13 | | Matrix: Solid | |
| Date Sampled: 09/14/2021 1225 | Project Name: ESTCP GAAF | % Solids: 99.2 | 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 91 | 50-150 | | 84 | 50-150 |
| d5-EtFOSAA | | 93 | 50-150 | | 80 | 50-150 |
| d-MeFOSA | | 101 | 50-150 | | 81 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 | | 93 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-004
Description: SB-VRTB-03_13-13.5 | Matrix: Solid
Date Sampled: 09/14/2021 1235 | Project Name: ESTCP GAAF | % Solids: 98.6 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/20/2021 1959 | JJG | 09/19/2021 1515 | 15796 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 1924 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.44 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.45 | ug/kg | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.44 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.44 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.44 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.44 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.44 | U | 0.88 | 0.44 | 0.18 | ug/kg | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 89 | 50-150 | | 81 | 50-150 |
| 13C2_6:2FTS | | 85 | 50-150 | | 89 | 50-150 |
| 13C2_8:2FTS | | 85 | 50-150 | | 83 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 | | 76 | 50-150 |
| 13C2_PFTeDA | | 86 | 50-150 | | 84 | 50-150 |
| 13C3_PFBS | | 88 | 50-150 | | 89 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 | | 92 | 50-150 |
| 13C4_PFBA | | 86 | 50-150 | | 86 | 50-150 |
| 13C4_PFHpA | | 86 | 50-150 | | 84 | 50-150 |
| 13C5_PFHxA | | 90 | 50-150 | | 79 | 50-150 |
| 13C5_PFPeA | | 85 | 50-150 | | 88 | 50-150 |
| 13C6_PFDA | | 86 | 50-150 | | 85 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 | | 81 | 50-150 |
| 13C8_PFOA | | 87 | 50-150 | | 87 | 50-150 |
| 13C8_PFOS | | 94 | 50-150 | | 86 | 50-150 |
| 13C8_PFOSA | | 83 | 50-150 | | 89 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-004 | |
| Description: SB-VRTB-03_13-13.5 | | Matrix: Solid | |
| Date Sampled: 09/14/2021 1235 | Project Name: ESTCP GAAF | % Solids: 98.6 | 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | | 85 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 | | 80 | 50-150 |
| d-MeFOSA | | 93 | 50-150 | | 87 | 50-150 |
| d3-MeFOSAA | | 90 | 50-150 | | 85 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-006
Description: SB-VRTB-03_14-14.25 | Matrix: Solid
Date Sampled: 09/14/2021 1243 | Project Name: ESTCP GAAF | % Solids: 98.4 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 1935 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.46 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.46 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.46 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.46 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.46 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.46 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.46 | U | 0.92 | 0.46 | 0.18 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 85 | 50-150 |
| 13C2_6:2FTS | | 91 | 50-150 |
| 13C2_8:2FTS | | 88 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 |
| 13C2_PFTeDA | | 80 | 50-150 |
| 13C3_PFBS | | 88 | 50-150 |
| 13C3_PFHxS | | 90 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 |
| 13C5_PFHxA | | 82 | 50-150 |
| 13C5_PFPeA | | 86 | 50-150 |
| 13C6_PFDA | | 83 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 83 | 50-150 |
| 13C8_PFOS | | 92 | 50-150 |
| 13C8_PFOSA | | 92 | 50-150 |
| 13C9_PFNA | | 82 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-006 |
| Description: SB-VRTB-03_14-14.25 | | Matrix: Solid |
| Date Sampled: 09/14/2021 1243 | Project Name: ESTCP GAAF | % Solids: 98.4 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 81 | 50-150 |
| d-MeFOSA | | 89 | 50-150 |
| d3-MeFOSAA | | 85 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-007
Description: SB-VRTB-03_14.25-14.5 | Matrix: Solid
Date Sampled: 09/14/2021 1245 | Project Name: ESTCP GAAF | % Solids: 98.4 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 1945 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 0.85 | U | 1.7 | 0.85 | 0.43 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 0.85 | U | 1.7 | 0.85 | 0.43 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 0.85 | U | 1.7 | 0.85 | 0.43 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 0.85 | U | 1.7 | 0.85 | 0.43 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 0.85 | U | 1.7 | 0.85 | 0.43 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 0.85 | U | 1.7 | 0.85 | 0.43 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.44 | U | 0.87 | 0.44 | 0.17 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 83 | 50-150 |
| 13C2_6:2FTS | | 84 | 50-150 |
| 13C2_8:2FTS | | 83 | 50-150 |
| 13C2_PFDoA | | 78 | 50-150 |
| 13C2_PFTeDA | | 77 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 |
| 13C3_PFHxS | | 86 | 50-150 |
| 13C4_PFBA | | 83 | 50-150 |
| 13C4_PFHpA | | 80 | 50-150 |
| 13C5_PFHxA | | 80 | 50-150 |
| 13C5_PFPeA | | 85 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 84 | 50-150 |
| 13C8_PFOA | | 84 | 50-150 |
| 13C8_PFOS | | 81 | 50-150 |
| 13C8_PFOSA | | 86 | 50-150 |
| 13C9_PFNA | | 85 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-007 |
| Description: SB-VRTB-03_14.25-14.5 | | Matrix: Solid |
| Date Sampled: 09/14/2021 1245 | Project Name: ESTCP GAAF | % Solids: 98.4 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 76 | 50-150 |
| d-MeFOSA | | 87 | 50-150 |
| d3-MeFOSAA | | 82 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-009
Description: SB-VRTB-03_15.25-15.5 | Matrix: Solid
Date Sampled: 09/14/2021 1415 | Project Name: ESTCP GAAF | % Solids: 93.4 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 1956 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.20 | J | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.47 | U | 0.94 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.48 | J | 0.94 | 0.47 | 0.19 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 86 | 50-150 |
| 13C2_6:2FTS | | 83 | 50-150 |
| 13C2_8:2FTS | | 76 | 50-150 |
| 13C2_PFDoA | | 76 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 |
| 13C3_PFBS | | 86 | 50-150 |
| 13C3_PFHxS | | 86 | 50-150 |
| 13C4_PFBA | | 81 | 50-150 |
| 13C4_PFHpA | | 80 | 50-150 |
| 13C5_PFHxA | | 75 | 50-150 |
| 13C5_PFPeA | | 85 | 50-150 |
| 13C6_PFDA | | 80 | 50-150 |
| 13C7_PFUdA | | 82 | 50-150 |
| 13C8_PFOA | | 81 | 50-150 |
| 13C8_PFOS | | 87 | 50-150 |
| 13C8_PFOSA | | 88 | 50-150 |
| 13C9_PFNA | | 79 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-009 |
| Description: SB-VRTB-03_15.25-15.5 | | Matrix: Solid |
| Date Sampled: 09/14/2021 1415 | Project Name: ESTCP GAAF | % Solids: 93.4 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 78 | 50-150 |
| d-MeFOSA | | 93 | 50-150 |
| d3-MeFOSAA | | 84 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-010
Description: SB-VRTB-03_15.75-16 | Matrix: Solid
Date Sampled: 09/14/2021 1420 | Project Name: ESTCP GAAF | % Solids: 91.5 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2006 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.48 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.48 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.48 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.48 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.48 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.48 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.49 | U | 0.97 | 0.49 | 0.19 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.94 | J | 0.97 | 0.49 | 0.19 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 83 | 50-150 |
| 13C2_6:2FTS | | 86 | 50-150 |
| 13C2_8:2FTS | | 83 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 |
| 13C2_PFTeDA | | 86 | 50-150 |
| 13C3_PFBS | | 90 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 |
| 13C4_PFBA | | 88 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 |
| 13C5_PFHxA | | 87 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 88 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 |
| 13C8_PFOS | | 87 | 50-150 |
| 13C8_PFOSA | | 95 | 50-150 |
| 13C9_PFNA | | 88 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-010 |
| Description: SB-VRTB-03_15.75-16 | | Matrix: Solid |
| Date Sampled: 09/14/2021 1420 | Project Name: ESTCP GAAF | % Solids: 91.5 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 85 | 50-150 |
| d-MeFOSA | | 91 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-011
Description: SB-VRTB-03_16.25-16.5 | Matrix: Solid
Date Sampled: 09/14/2021 1425 | Project Name: ESTCP GAAF | % Solids: 90.1 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2017 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 3.1 | | 1.1 | 0.55 | 0.21 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 92 | 50-150 |
| 13C2_8:2FTS | | 87 | 50-150 |
| 13C2_PFDoA | | 78 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 |
| 13C3_PFHxS | | 99 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 |
| 13C4_PFHpA | | 90 | 50-150 |
| 13C5_PFHxA | | 86 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 |
| 13C7_PFUdA | | 86 | 50-150 |
| 13C8_PFOA | | 87 | 50-150 |
| 13C8_PFOS | | 90 | 50-150 |
| 13C8_PFOSA | | 95 | 50-150 |
| 13C9_PFNA | | 86 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-011 |
| Description: SB-VRTB-03_16.25-16.5 | | Matrix: Solid |
| Date Sampled: 09/14/2021 1425 | Project Name: ESTCP GAAF | % Solids: 90.1 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 87 | 50-150 |
| d-MeFOSA | | 91 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-013
Description: SB-VRTB-03_17-17.5 | Matrix: Solid
Date Sampled: 09/14/2021 1440 | Project Name: ESTCP GAAF | % Solids: 93.3 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2028 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.24 | J | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 7.1 | | 1.0 | 0.50 | 0.21 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 87 | 50-150 |
| 13C2_6:2FTS | | 84 | 50-150 |
| 13C2_8:2FTS | | 81 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 |
| 13C3_PFBS | | 86 | 50-150 |
| 13C3_PFHxS | | 87 | 50-150 |
| 13C4_PFBA | | 86 | 50-150 |
| 13C4_PFHpA | | 81 | 50-150 |
| 13C5_PFHxA | | 79 | 50-150 |
| 13C5_PFPeA | | 83 | 50-150 |
| 13C6_PFDA | | 86 | 50-150 |
| 13C7_PFUdA | | 84 | 50-150 |
| 13C8_PFOA | | 84 | 50-150 |
| 13C8_PFOS | | 84 | 50-150 |
| 13C8_PFOSA | | 92 | 50-150 |
| 13C9_PFNA | | 84 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-013 |
| Description: SB-VRTB-03_17-17.5 | | Matrix: Solid |
| Date Sampled: 09/14/2021 1440 | Project Name: ESTCP GAAF | % Solids: 93.3 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 81 | 50-150 |
| d-MeFOSA | | 82 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-014
Description: SB-VRTB-03_18-18.5 | Matrix: Solid
Date Sampled: 09/14/2021 1445 | Project Name: ESTCP GAAF | % Solids: 90.8 | 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2110 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.37 | J | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 41 | | 1.1 | 0.55 | 0.21 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 88 | 50-150 |
| 13C2_6:2FTS | | 91 | 50-150 |
| 13C2_8:2FTS | | 84 | 50-150 |
| 13C2_PFDoA | | 82 | 50-150 |
| 13C2_PFTeDA | | 83 | 50-150 |
| 13C3_PFBS | | 88 | 50-150 |
| 13C3_PFHxS | | 83 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 84 | 50-150 |
| 13C5_PFHxA | | 84 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 88 | 50-150 |
| 13C7_PFUdA | | 86 | 50-150 |
| 13C8_PFOA | | 87 | 50-150 |
| 13C8_PFOS | | 84 | 50-150 |
| 13C8_PFOSA | | 90 | 50-150 |
| 13C9_PFNA | | 82 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-014 |
| Description: SB-VRTB-03_18-18.5 | | Matrix: Solid |
| Date Sampled: 09/14/2021 1445 | Project Name: ESTCP GAAF | % Solids: 90.8 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 86 | 50-150 |
| d3-MeFOSAA | | 95 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-016
Description: SB-VRTB-03_20.5-21 | Matrix: Solid
Date Sampled: 09/14/2021 1550 | Project Name: ESTCP GAAF | % Solids: 90.0 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2120 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 0.95 | U | 1.9 | 0.95 | 0.47 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.47 | U | 0.93 | 0.47 | 0.19 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1.4 | | 0.93 | 0.47 | 0.19 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 91 | 50-150 |
| 13C2_6:2FTS | | 109 | 50-150 |
| 13C2_8:2FTS | | 93 | 50-150 |
| 13C2_PFDoA | | 82 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 |
| 13C3_PFBS | | 87 | 50-150 |
| 13C3_PFHxS | | 86 | 50-150 |
| 13C4_PFBA | | 83 | 50-150 |
| 13C4_PFHpA | | 85 | 50-150 |
| 13C5_PFHxA | | 83 | 50-150 |
| 13C5_PFPeA | | 86 | 50-150 |
| 13C6_PFDA | | 88 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 |
| 13C8_PFOS | | 90 | 50-150 |
| 13C8_PFOSA | | 90 | 50-150 |
| 13C9_PFNA | | 84 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-016 |
| Description: SB-VRTB-03_20.5-21 | | Matrix: Solid |
| Date Sampled: 09/14/2021 1550 | Project Name: ESTCP GAAF | % Solids: 90.0 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 83 | 50-150 |
| d-MeFOSA | | 76 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-018
Description: SB-VRTB-03_24-24.5 | Matrix: Solid
Date Sampled: 09/14/2021 1600 | Project Name: ESTCP GAAF | % Solids: 88.3 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2131 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.28 | J | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 10 | | 1.0 | 0.50 | 0.21 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 82 | 50-150 |
| 13C2_6:2FTS | | 87 | 50-150 |
| 13C2_8:2FTS | | 85 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 77 | 50-150 |
| 13C3_PFBS | | 84 | 50-150 |
| 13C3_PFHxS | | 83 | 50-150 |
| 13C4_PFBA | | 84 | 50-150 |
| 13C4_PFHpA | | 83 | 50-150 |
| 13C5_PFHxA | | 81 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 |
| 13C6_PFDA | | 83 | 50-150 |
| 13C7_PFUdA | | 77 | 50-150 |
| 13C8_PFOA | | 84 | 50-150 |
| 13C8_PFOS | | 78 | 50-150 |
| 13C8_PFOSA | | 85 | 50-150 |
| 13C9_PFNA | | 77 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-018 |
| Description: SB-VRTB-03_24-24.5 | | Matrix: Solid |
| Date Sampled: 09/14/2021 1600 | Project Name: ESTCP GAAF | % Solids: 88.3 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 75 | 50-150 |
| d-MeFOSA | | 78 | 50-150 |
| d3-MeFOSAA | | 82 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-020
Description: SB-VRTB-03_27-27.5 | Matrix: Solid
Date Sampled: 09/15/2021 0950 | Project Name: ESTCP GAAF | % Solids: 86.5 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2141 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 1.2 | U | 2.3 | 1.2 | 0.57 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.2 | U | 2.3 | 1.2 | 0.57 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 1.2 | U | 2.3 | 1.2 | 0.57 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 1.2 | U | 2.3 | 1.2 | 0.57 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1.2 | U | 2.3 | 1.2 | 0.57 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 1.2 | U | 2.3 | 1.2 | 0.57 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.23 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 88 | 50-150 |
| 13C2_6:2FTS | | 90 | 50-150 |
| 13C2_8:2FTS | | 86 | 50-150 |
| 13C2_PFDoA | | 81 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 |
| 13C3_PFBS | | 87 | 50-150 |
| 13C3_PFHxS | | 89 | 50-150 |
| 13C4_PFBA | | 86 | 50-150 |
| 13C4_PFHpA | | 83 | 50-150 |
| 13C5_PFHxA | | 84 | 50-150 |
| 13C5_PFPeA | | 81 | 50-150 |
| 13C6_PFDA | | 84 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 86 | 50-150 |
| 13C8_PFOS | | 85 | 50-150 |
| 13C8_PFOSA | | 90 | 50-150 |
| 13C9_PFNA | | 84 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-020 |
| Description: SB-VRTB-03_27-27.5 | | Matrix: Solid |
| Date Sampled: 09/15/2021 0950 | Project Name: ESTCP GAAF | % Solids: 86.5 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 80 | 50-150 |
| d-MeFOSA | | 92 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-022
Description: SB-VRTB-03_32-32.5 | Matrix: Solid
Date Sampled: 09/15/2021 1048 | Project Name: ESTCP GAAF | % Solids: 87.9 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2152 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.50 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.21 | J | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 5.8 | S | 1.0 | 0.50 | 0.20 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 80 | 50-150 |
| 13C2_6:2FTS | | 85 | 50-150 |
| 13C2_8:2FTS | | 80 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 |
| 13C3_PFHxS | | 86 | 50-150 |
| 13C4_PFBA | | 84 | 50-150 |
| 13C4_PFHpA | | 85 | 50-150 |
| 13C5_PFHxA | | 78 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 |
| 13C6_PFDA | | 86 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 84 | 50-150 |
| 13C8_PFOS | | 83 | 50-150 |
| 13C8_PFOSA | | 84 | 50-150 |
| 13C9_PFNA | | 78 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-022 |
| Description: SB-VRTB-03_32-32.5 | | Matrix: Solid |
| Date Sampled: 09/15/2021 1048 | Project Name: ESTCP GAAF | % Solids: 87.9 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 76 | 50-150 |
| d-MeFOSA | | 79 | 50-150 |
| d3-MeFOSAA | | 82 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-023
Description: SB-VRTB-03_34-34.5 | Matrix: Solid
Date Sampled: 09/15/2021 1052 | Project Name: ESTCP GAAF | % Solids: 88.4 | 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2223 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.53 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.55 | U | 1.1 | 0.55 | 0.21 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 86 | 50-150 |
| 13C2_6:2FTS | | 79 | 50-150 |
| 13C2_8:2FTS | | 70 | 50-150 |
| 13C2_PFDoA | | 72 | 50-150 |
| 13C2_PFTeDA | | 74 | 50-150 |
| 13C3_PFBS | | 81 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 |
| 13C4_PFBA | | 82 | 50-150 |
| 13C4_PFHpA | | 78 | 50-150 |
| 13C5_PFHxA | | 76 | 50-150 |
| 13C5_PFPeA | | 84 | 50-150 |
| 13C6_PFDA | | 79 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 78 | 50-150 |
| 13C8_PFOS | | 73 | 50-150 |
| 13C8_PFOSA | | 84 | 50-150 |
| 13C9_PFNA | | 80 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-023 |
| Description: SB-VRTB-03_34-34.5 | | Matrix: Solid |
| Date Sampled: 09/15/2021 1052 | Project Name: ESTCP GAAF | % Solids: 88.4 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 76 | 50-150 |
| d-MeFOSA | | 81 | 50-150 |
| d3-MeFOSAA | | 82 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-024
Description: SB-VRTB-03_35-35.5 | Matrix: Solid
Date Sampled: 09/15/2021 1146 | Project Name: ESTCP GAAF | % Solids: 85.6 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2234 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.49 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.49 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.49 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.49 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.49 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 1.0 | U | 2.0 | 1.0 | 0.49 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.50 | U | 0.99 | 0.50 | 0.20 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 93 | 50-150 |
| 13C2_6:2FTS | | 106 | 50-150 |
| 13C2_8:2FTS | | 125 | 50-150 |
| 13C2_PFDoA | | 85 | 50-150 |
| 13C2_PFTeDA | | 83 | 50-150 |
| 13C3_PFBS | | 87 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 83 | 50-150 |
| 13C5_PFHxA | | 85 | 50-150 |
| 13C5_PFPeA | | 86 | 50-150 |
| 13C6_PFDA | | 99 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 85 | 50-150 |
| 13C8_PFOS | | 90 | 50-150 |
| 13C8_PFOSA | | 90 | 50-150 |
| 13C9_PFNA | | 87 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-024 |
| Description: SB-VRTB-03_35-35.5 | | Matrix: Solid |
| Date Sampled: 09/15/2021 1146 | Project Name: ESTCP GAAF | % Solids: 85.6 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 91 | 50-150 |
| d-MeFOSA | | 72 | 50-150 |
| d3-MeFOSAA | | 105 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-026
Description: SB-VRTB-DUP-01 | Matrix: Solid
Date Sampled: 09/15/2021 | Project Name: ESTCP GAAF | % Solids: 98.7 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2244 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.44 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.44 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.44 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.44 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.44 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 0.90 | U | 1.8 | 0.90 | 0.44 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.45 | U | 0.89 | 0.45 | 0.18 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 82 | 50-150 |
| 13C2_6:2FTS | | 79 | 50-150 |
| 13C2_8:2FTS | | 82 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 |
| 13C2_PFTeDA | | 77 | 50-150 |
| 13C3_PFBS | | 86 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 |
| 13C4_PFBA | | 83 | 50-150 |
| 13C4_PFHpA | | 82 | 50-150 |
| 13C5_PFHxA | | 80 | 50-150 |
| 13C5_PFPeA | | 82 | 50-150 |
| 13C6_PFDA | | 84 | 50-150 |
| 13C7_PFUdA | | 82 | 50-150 |
| 13C8_PFOA | | 83 | 50-150 |
| 13C8_PFOS | | 79 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 |
| 13C9_PFNA | | 79 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-026 |
| Description: SB-VRTB-DUP-01 | | Matrix: Solid |
| Date Sampled: 09/15/2021 | Project Name: ESTCP GAAF | % Solids: 98.7 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 87 | 50-150 |
| d3-MeFOSAA | | 82 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI18011-027
Description: SB-VRTB-DUP-02 | Matrix: Solid
Date Sampled: 09/15/2021 | Project Name: ESTCP GAAF | % Solids: 88.4 09/20/2021 2245
Date Received: 09/18/2021 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/07/2021 2255 | JJG | 10/06/2021 1159 | 17853 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 1.1 | U | 2.1 | 1.1 | 0.52 | ug/kg | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 0.50 | U | 1.0 | 0.50 | 0.21 | ug/kg | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 91 | 50-150 |
| 13C2_6:2FTS | | 87 | 50-150 |
| 13C2_8:2FTS | | 78 | 50-150 |
| 13C2_PFDoA | | 83 | 50-150 |
| 13C2_PFTeDA | | 83 | 50-150 |
| 13C3_PFBS | | 89 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 86 | 50-150 |
| 13C5_PFHxA | | 84 | 50-150 |
| 13C5_PFPeA | | 91 | 50-150 |
| 13C6_PFDA | | 88 | 50-150 |
| 13C7_PFUdA | | 86 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 |
| 13C8_PFOS | | 89 | 50-150 |
| 13C8_PFOSA | | 92 | 50-150 |
| 13C9_PFNA | | 81 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | |
|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WI18011-027 |
| Description: SB-VRTB-DUP-02 | | Matrix: Solid |
| Date Sampled: 09/15/2021 | Project Name: ESTCP GAAF | % Solids: 88.4 09/20/2021 2245 |
| Date Received: 09/18/2021 | Project Number: 30027244 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 87 | 50-150 |
| d-MeFOSA | | 85 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: WQ15796-001
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 1.0 | U | 1 | 2.0 | 1.0 | 0.50 | ug/kg | 09/20/2021 1358 |
| 4:2 FTS | 1.0 | U | 1 | 2.0 | 1.0 | 0.50 | ug/kg | 09/20/2021 1358 |
| EtFOSAA | 1.0 | U | 1 | 2.0 | 1.0 | 0.50 | ug/kg | 09/20/2021 1358 |
| MeFOSA | 1.0 | U | 1 | 2.0 | 1.0 | 0.50 | ug/kg | 09/20/2021 1358 |
| MeFOSAA | 1.0 | U | 1 | 2.0 | 1.0 | 0.50 | ug/kg | 09/20/2021 1358 |
| PFBS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFDS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFHpS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFNS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFOSA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFPeS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFHxS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFBA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFDA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFDoA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFHpA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFHxA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFNA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFOA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFPeA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFTeDA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFTrDA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFUdA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |
| PFOS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 09/20/2021 1358 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 91 | 50-150 |
| 13C2_6:2FTS | | 95 | 50-150 |
| 13C2_8:2FTS | | 96 | 50-150 |
| 13C2_PFDoA | | 95 | 50-150 |
| 13C2_PFTeDA | | 96 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 |
| 13C6_PFDA | | 99 | 50-150 |
| 13C7_PFUdA | | 104 | 50-150 |
| 13C8_PFOA | | 97 | 50-150 |
| 13C8_PFOS | | 99 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: WQ15796-001
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOSA | | 92 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |
| d5-EtFOSAA | | 103 | 50-150 |
| d-MeFOSA | | 100 | 50-150 |
| d3-MeFOSAA | | 104 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: WQ15796-002
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

| Parameter | Spike Amount (ug/kg) | Result (ug/kg) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 1.9 | 1.7 | | 1 | 90 | 65-137 | 09/20/2021 1409 |
| 4:2 FTS | 1.9 | 1.9 | | 1 | 104 | 62-145 | 09/20/2021 1409 |
| EtFOSAA | 2.0 | 1.4 | | 1 | 70 | 61-139 | 09/20/2021 1409 |
| MeFOSA | 2.0 | 1.7 | | 1 | 84 | 70-150 | 09/20/2021 1409 |
| MeFOSAA | 2.0 | 1.9 | | 1 | 93 | 63-144 | 09/20/2021 1409 |
| PFBS | 1.8 | 1.5 | | 1 | 83 | 72-128 | 09/20/2021 1409 |
| PFDS | 1.9 | 2.0 | | 1 | 102 | 59-134 | 09/20/2021 1409 |
| PFHpS | 1.9 | 1.6 | | 1 | 86 | 70-132 | 09/20/2021 1409 |
| PFNS | 1.9 | 1.7 | | 1 | 87 | 69-125 | 09/20/2021 1409 |
| PFOSA | 2.0 | 2.0 | | 1 | 100 | 67-137 | 09/20/2021 1409 |
| PFPeS | 1.9 | 1.6 | | 1 | 86 | 73-123 | 09/20/2021 1409 |
| PFHxS | 1.8 | 1.9 | | 1 | 104 | 67-130 | 09/20/2021 1409 |
| PFBA | 2.0 | 1.8 | | 1 | 91 | 71-135 | 09/20/2021 1409 |
| PFDA | 2.0 | 2.0 | | 1 | 98 | 69-133 | 09/20/2021 1409 |
| PFDoA | 2.0 | 2.0 | | 1 | 101 | 69-135 | 09/20/2021 1409 |
| PFHpA | 2.0 | 1.9 | | 1 | 93 | 71-131 | 09/20/2021 1409 |
| PFHxA | 2.0 | 1.8 | | 1 | 92 | 70-132 | 09/20/2021 1409 |
| PFNA | 2.0 | 1.8 | | 1 | 90 | 72-129 | 09/20/2021 1409 |
| PFOA | 2.0 | 1.8 | | 1 | 89 | 69-133 | 09/20/2021 1409 |
| PFPeA | 2.0 | 1.8 | | 1 | 91 | 69-132 | 09/20/2021 1409 |
| PFTeDA | 2.0 | 1.8 | | 1 | 92 | 69-133 | 09/20/2021 1409 |
| PFTrDA | 2.0 | 1.9 | | 1 | 94 | 66-139 | 09/20/2021 1409 |
| PFUdA | 2.0 | 1.9 | | 1 | 94 | 64-136 | 09/20/2021 1409 |
| PFOS | 1.9 | 1.5 | | 1 | 79 | 68-136 | 09/20/2021 1409 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 92 | 50-150 |
| 13C2_6:2FTS | | 89 | 50-150 |
| 13C2_8:2FTS | | 91 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 |
| 13C2_PFTeDA | | 92 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 91 | 50-150 |
| 13C4_PFHpA | | 91 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 |
| 13C6_PFDA | | 88 | 50-150 |
| 13C7_PFUdA | | 84 | 50-150 |
| 13C8_PFOA | | 91 | 50-150 |
| 13C8_PFOS | | 92 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: WQ15796-002
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOSA | | 88 | 50-150 |
| 13C9_PFNA | | 95 | 50-150 |
| d5-EtFOSAA | | 97 | 50-150 |
| d-MeFOSA | | 92 | 50-150 |
| d3-MeFOSAA | | 95 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: WQ17853-001
Batch: 17853
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/06/2021 1159

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 1.0 | U | 1 | 2.0 | 1.0 | 0.50 | ug/kg | 10/07/2021 1832 |
| 6:2 FTS | 1.0 | U | 1 | 2.0 | 1.0 | 0.50 | ug/kg | 10/07/2021 1832 |
| 4:2 FTS | 1.0 | U | 1 | 2.0 | 1.0 | 0.50 | ug/kg | 10/07/2021 1832 |
| EtFOSAA | 1.0 | U | 1 | 2.0 | 1.0 | 0.50 | ug/kg | 10/07/2021 1832 |
| MeFOSA | 1.0 | U | 1 | 2.0 | 1.0 | 0.50 | ug/kg | 10/07/2021 1832 |
| MeFOSAA | 1.0 | U | 1 | 2.0 | 1.0 | 0.50 | ug/kg | 10/07/2021 1832 |
| PFBS | 0.20 | J | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFDS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFHpS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFNS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFOSA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFPeS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFHxS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFBA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFDA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFDoA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFHpA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFHxA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFNA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFOA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFPeA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFTeDA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFTrDA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFUdA | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |
| PFOS | 0.50 | U | 1 | 1.0 | 0.50 | 0.20 | ug/kg | 10/07/2021 1832 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 87 | 50-150 |
| 13C2_6:2FTS | | 86 | 50-150 |
| 13C2_8:2FTS | | 87 | 50-150 |
| 13C2_PFDoA | | 83 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 |
| 13C3_PFBS | | 87 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 88 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 |
| 13C5_PFHxA | | 82 | 50-150 |
| 13C5_PFPeA | | 85 | 50-150 |
| 13C6_PFDA | | 86 | 50-150 |
| 13C7_PFUdA | | 84 | 50-150 |
| 13C8_PFOA | | 89 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: WQ17853-001
Batch: 17853
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/06/2021 1159

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 90 | 50-150 |
| 13C8_PFOSA | | 94 | 50-150 |
| 13C9_PFNA | | 85 | 50-150 |
| d5-EtFOSAA | | 83 | 50-150 |
| d-MeFOSA | | 93 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: WQ17853-002
Batch: 17853
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/06/2021 1159

| Parameter | Spike Amount (ug/kg) | Result (ug/kg) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 1.9 | 1.8 | | 1 | 93 | 65-137 | 10/07/2021 1842 |
| 6:2 FTS | 1.9 | 1.7 | | 1 | 89 | 64-140 | 10/07/2021 1842 |
| 4:2 FTS | 1.9 | 2.0 | | 1 | 108 | 62-145 | 10/07/2021 1842 |
| EtFOSAA | 2.0 | 1.9 | | 1 | 94 | 61-139 | 10/07/2021 1842 |
| MeFOSA | 2.0 | 2.0 | | 1 | 98 | 70-150 | 10/07/2021 1842 |
| MeFOSAA | 2.0 | 1.8 | | 1 | 89 | 63-144 | 10/07/2021 1842 |
| PFBS | 1.8 | 1.8 | | 1 | 100 | 72-128 | 10/07/2021 1842 |
| PFDS | 1.9 | 2.0 | | 1 | 105 | 59-134 | 10/07/2021 1842 |
| PFHpS | 1.9 | 1.8 | | 1 | 96 | 70-132 | 10/07/2021 1842 |
| PFNS | 1.9 | 1.5 | | 1 | 78 | 69-125 | 10/07/2021 1842 |
| PFOSA | 2.0 | 1.8 | | 1 | 89 | 67-137 | 10/07/2021 1842 |
| PFPeS | 1.9 | 1.8 | | 1 | 97 | 73-123 | 10/07/2021 1842 |
| PFHxS | 1.8 | 1.8 | | 1 | 100 | 67-130 | 10/07/2021 1842 |
| PFBA | 2.0 | 1.9 | | 1 | 97 | 71-135 | 10/07/2021 1842 |
| PFDA | 2.0 | 1.9 | | 1 | 96 | 69-133 | 10/07/2021 1842 |
| PFDoA | 2.0 | 1.9 | | 1 | 95 | 69-135 | 10/07/2021 1842 |
| PFHpA | 2.0 | 1.8 | | 1 | 90 | 71-131 | 10/07/2021 1842 |
| PFHxA | 2.0 | 2.0 | | 1 | 99 | 70-132 | 10/07/2021 1842 |
| PFNA | 2.0 | 1.8 | | 1 | 90 | 72-129 | 10/07/2021 1842 |
| PFOA | 2.0 | 2.0 | | 1 | 102 | 69-133 | 10/07/2021 1842 |
| PFPeA | 2.0 | 1.8 | | 1 | 92 | 69-132 | 10/07/2021 1842 |
| PFTeDA | 2.0 | 1.8 | | 1 | 92 | 69-133 | 10/07/2021 1842 |
| PFTrDA | 2.0 | 1.9 | | 1 | 95 | 66-139 | 10/07/2021 1842 |
| PFUdA | 2.0 | 1.9 | | 1 | 95 | 64-136 | 10/07/2021 1842 |
| PFOS | 1.9 | 2.1 | | 1 | 115 | 68-136 | 10/07/2021 1842 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 88 | 50-150 |
| 13C2_6:2FTS | | 81 | 50-150 |
| 13C2_8:2FTS | | 78 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 80 | 50-150 |
| 13C3_PFBS | | 86 | 50-150 |
| 13C3_PFHxS | | 89 | 50-150 |
| 13C4_PFBA | | 84 | 50-150 |
| 13C4_PFHpA | | 84 | 50-150 |
| 13C5_PFHxA | | 80 | 50-150 |
| 13C5_PFPeA | | 85 | 50-150 |
| 13C6_PFDA | | 81 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 83 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: WQ17853-002
Batch: 17853
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/06/2021 1159

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 85 | 50-150 |
| 13C8_PFOSA | | 86 | 50-150 |
| 13C9_PFNA | | 79 | 50-150 |
| d5-EtFOSAA | | 80 | 50-150 |
| d-MeFOSA | | 81 | 50-150 |
| d3-MeFOSAA | | 86 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: WI18011-022MS
Batch: 17853
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/06/2021 1159

| Parameter | Sample Amount (ug/kg) | Spike Amount (ug/kg) | Result (ug/kg) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | 2.0 | 2.2 | | 1 | 111 | 65-137 | 10/07/2021 2202 |
| 6:2 FTS | ND | 2.0 | 1.9 | | 1 | 96 | 64-140 | 10/07/2021 2202 |
| 4:2 FTS | ND | 2.0 | 1.7 | | 1 | 87 | 62-145 | 10/07/2021 2202 |
| EtFOSAA | ND | 2.1 | 1.6 | | 1 | 78 | 61-139 | 10/07/2021 2202 |
| MeFOSA | ND | 2.1 | 2.6 | | 1 | 122 | 70-150 | 10/07/2021 2202 |
| MeFOSAA | ND | 2.1 | 2.3 | | 1 | 109 | 63-144 | 10/07/2021 2202 |
| PFBS | ND | 1.9 | 1.8 | | 1 | 95 | 72-128 | 10/07/2021 2202 |
| PFDS | ND | 2.0 | 1.7 | | 1 | 84 | 59-134 | 10/07/2021 2202 |
| PFHpS | ND | 2.0 | 2.1 | | 1 | 107 | 70-132 | 10/07/2021 2202 |
| PFNS | ND | 2.0 | 1.9 | | 1 | 95 | 69-125 | 10/07/2021 2202 |
| PFOSA | ND | 2.1 | 2.0 | | 1 | 93 | 67-137 | 10/07/2021 2202 |
| PFPeS | ND | 2.0 | 2.0 | | 1 | 103 | 73-123 | 10/07/2021 2202 |
| PFHxS | 0.21 | 1.9 | 2.0 | | 1 | 102 | 67-130 | 10/07/2021 2202 |
| PFBA | ND | 2.1 | 2.0 | | 1 | 94 | 71-135 | 10/07/2021 2202 |
| PFDA | ND | 2.1 | 1.9 | | 1 | 91 | 69-133 | 10/07/2021 2202 |
| PFDoA | ND | 2.1 | 2.0 | | 1 | 97 | 69-135 | 10/07/2021 2202 |
| PFHpA | ND | 2.1 | 2.0 | | 1 | 96 | 71-131 | 10/07/2021 2202 |
| PFHxA | ND | 2.1 | 2.2 | | 1 | 103 | 70-132 | 10/07/2021 2202 |
| PFNA | ND | 2.1 | 1.9 | | 1 | 91 | 72-129 | 10/07/2021 2202 |
| PFOA | ND | 2.1 | 2.0 | | 1 | 97 | 69-133 | 10/07/2021 2202 |
| PFPeA | ND | 2.1 | 2.2 | | 1 | 104 | 69-132 | 10/07/2021 2202 |
| PFTeDA | ND | 2.1 | 2.0 | | 1 | 96 | 69-133 | 10/07/2021 2202 |
| PFTrDA | ND | 2.1 | 2.0 | | 1 | 96 | 66-139 | 10/07/2021 2202 |
| PFUdA | ND | 2.1 | 2.0 | | 1 | 93 | 64-136 | 10/07/2021 2202 |
| PFOS | 5.8 | 1.9 | 8.7 | N | 1 | 149 | 68-136 | 10/07/2021 2202 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 88 | 50-150 |
| 13C2_6:2FTS | | 88 | 50-150 |
| 13C2_8:2FTS | | 88 | 50-150 |
| 13C2_PFDoA | | 89 | 50-150 |
| 13C2_PFTeDA | | 85 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 |
| 13C3_PFHxS | | 88 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 85 | 50-150 |
| 13C5_PFHxA | | 83 | 50-150 |
| 13C5_PFPeA | | 84 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 |
| 13C7_PFUdA | | 103 | 50-150 |
| 13C8_PFOA | | 86 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: WI18011-022MS
Batch: 17853
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/06/2021 1159

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 |
| 13C9_PFNA | | 89 | 50-150 |
| d5-EtFOSAA | | 101 | 50-150 |
| d-MeFOSA | | 85 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: WI18011-022MD
Batch: 17853
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/06/2021 1159

| Parameter | Sample Amount (ug/kg) | Spike Amount (ug/kg) | Result (ug/kg) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | 1.9 | 1.7 | | 1 | 90 | 28 | 65-137 | 30 | 10/07/2021 2213 |
| 6:2 FTS | ND | 1.8 | 2.0 | | 1 | 111 | 6.8 | 64-140 | 30 | 10/07/2021 2213 |
| 4:2 FTS | ND | 1.8 | 1.7 | | 1 | 96 | 2.1 | 62-145 | 30 | 10/07/2021 2213 |
| EtFOSAA | ND | 1.9 | 1.8 | | 1 | 95 | 11 | 61-139 | 30 | 10/07/2021 2213 |
| MeFOSA | ND | 1.9 | 1.8 | + | 1 | 95 | 33 | 70-150 | 30 | 10/07/2021 2213 |
| MeFOSAA | ND | 1.9 | 1.7 | | 1 | 88 | 29 | 63-144 | 30 | 10/07/2021 2213 |
| PFBS | ND | 1.7 | 1.8 | | 1 | 106 | 4.2 | 72-128 | 30 | 10/07/2021 2213 |
| PFDS | ND | 1.9 | 2.0 | | 1 | 107 | 15 | 59-134 | 30 | 10/07/2021 2213 |
| PFHpS | ND | 1.8 | 1.7 | | 1 | 92 | 23 | 70-132 | 30 | 10/07/2021 2213 |
| PFNS | ND | 1.9 | 2.2 | | 1 | 116 | 12 | 69-125 | 30 | 10/07/2021 2213 |
| PFOSA | ND | 1.9 | 1.9 | | 1 | 97 | 4.0 | 67-137 | 30 | 10/07/2021 2213 |
| PFPeS | ND | 1.8 | 1.7 | | 1 | 93 | 18 | 73-123 | 30 | 10/07/2021 2213 |
| PFHxS | 0.21 | 1.8 | 1.6 | | 1 | 89 | 22 | 67-130 | 30 | 10/07/2021 2213 |
| PFBA | ND | 1.9 | 1.9 | | 1 | 99 | 3.6 | 71-135 | 30 | 10/07/2021 2213 |
| PFDA | ND | 1.9 | 2.1 | | 1 | 108 | 8.3 | 69-133 | 30 | 10/07/2021 2213 |
| PFDoA | ND | 1.9 | 2.0 | | 1 | 103 | 2.9 | 69-135 | 30 | 10/07/2021 2213 |
| PFHpA | ND | 1.9 | 2.0 | | 1 | 103 | 1.3 | 71-131 | 30 | 10/07/2021 2213 |
| PFHxA | ND | 1.9 | 1.9 | | 1 | 100 | 12 | 70-132 | 30 | 10/07/2021 2213 |
| PFNA | ND | 1.9 | 1.9 | | 1 | 96 | 3.9 | 72-129 | 30 | 10/07/2021 2213 |
| PFOA | ND | 1.9 | 1.8 | | 1 | 95 | 10 | 69-133 | 30 | 10/07/2021 2213 |
| PFPeA | ND | 1.9 | 1.9 | | 1 | 100 | 12 | 69-132 | 30 | 10/07/2021 2213 |
| PFTeDA | ND | 1.9 | 1.9 | | 1 | 100 | 4.8 | 69-133 | 30 | 10/07/2021 2213 |
| PFTrDA | ND | 1.9 | 1.9 | | 1 | 98 | 6.3 | 66-139 | 30 | 10/07/2021 2213 |
| PFUdA | ND | 1.9 | 1.9 | | 1 | 101 | 0.94 | 64-136 | 30 | 10/07/2021 2213 |
| PFOS | 5.8 | 1.8 | 4.0 | N,+ | 1 | -100 | 74 | 68-136 | 30 | 10/07/2021 2213 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 83 | 50-150 |
| 13C2_6:2FTS | | 79 | 50-150 |
| 13C2_8:2FTS | | 77 | 50-150 |
| 13C2_PFDoA | | 76 | 50-150 |
| 13C2_PFTeDA | | 75 | 50-150 |
| 13C3_PFBS | | 78 | 50-150 |
| 13C3_PFHxS | | 89 | 50-150 |
| 13C4_PFBA | | 81 | 50-150 |
| 13C4_PFHpA | | 77 | 50-150 |
| 13C5_PFHxA | | 77 | 50-150 |
| 13C5_PFPeA | | 79 | 50-150 |
| 13C6_PFDA | | 79 | 50-150 |
| 13C7_PFUdA | | 79 | 50-150 |
| 13C8_PFOA | | 81 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Sample ID: WI18011-022MD
Batch: 17853
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/06/2021 1159

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 77 | 50-150 |
| 13C8_PFOSA | | 82 | 50-150 |
| 13C9_PFNA | | 75 | 50-150 |
| d5-EtFOSAA | | 78 | 50-150 |
| d-MeFOSA | | 73 | 50-150 |
| d3-MeFOSAA | | 83 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 125191

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: 248-994-2323 | Quote No. |
| Address: 28550 Cabot Drive Suite 500 | Sampler's Signature: X | Analysis (Attach list if more space is needed) | Page 1 of 3 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Kristen Hasbrouck | | |
| Project Name: ESTCP GAAF | | | |
| Project No.: 30027244 | P.O. No.: | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab=G, C=Composite | Matrix: Aqueous | Solid | Wipe/Air/Other | No. of Containers by Preservative Type: Unpres | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | Methanol | PFAS - DoD QSM Table B-15 | Tisa TOF | Top Assay | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SB-VRTB-03 - 10.5 - 11 | 9/14 | 1215 | G | | X | | 1 | | | | | | | X | | | |
| SB-VRTB-03 - 11.5 - 12 | 9/14 | 1220 | G | | X | | 1 | | | | | | | X | | | |
| SB-VRTB-03 - 12.5 - 13 | 9/14 | 1225 | G | | X | | 2 | | | | | | | X | X | | |
| SB-VRTB-03 - 13 - 13.5 | 9/14 | 1235 | G | | X | | 2 | | | | | | | X | X | | grain size sample on separate COC |
| SB-VRTB-03 - 13.75 - 14 | 9/14 | 1240 | G | | X | | 3 | | | | | | | X | X | X | |
| SB-VRTB-03 - 14 - 14.25 | 9/14 | 1243 | G | | X | | 1 | | | | | | | X | | | |
| SB-VRTB-03 - 14.25 - 14.5 | 9/14 | 1245 | G | | X | | 2 | | | | | | | X | X | | |
| SB-VRTB-03 - 14.75 - 15 | 9/14 | 1250 | G | | X | | 3 | | | | | | | X | X | X | |
| SB-VRTB-03 - 15.25 - 15.5 | 9/14 | 1415 | G | | X | | 2 | | | | | | | X | X | | |
| SB-VRTB-03 - 15.75 - 16 | 9/14 | 1420 | G | | X | | 2 | | | | | | | X | X | | |

WI18011
KES2

Turn Around Time Required (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client X Disposal by Lab

Possible Hazard Identification: X Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify): Level II

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by | 9/16 | 1700 | 1. Received by: FedEx | 9/16 | 1700 |
| 2. Relinquished by | 9/17/21 | 1030 | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: Fedex | 9/18/21 | 0930 | 4. Laboratory Received by | 9/18/21 | 09:30 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle): Yes No Ice Pack — Receipt Temp: 3.1 °C — Temp Blank: Y N

DISTRIBUTION: WHITE & YELLOW Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: MEG03N2-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 125192

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: 248-994-2323 | Quote No. |
| Address: 28550 Cabot Drive Suite 500 | Sampler's Signature: X | Analysis (Attach list if more space is needed) | Page 2 of 3 |
| City: Novi | State: MI | Zip Code: 48377 | Printed Name: Kristen Hasbrouck |
| Project Name: ESTCP EMAF | | | |

Project No.: 30027244 — P.O. No.:

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab / Composite | Matrix: Archive | Matrix: Soil | Matrix: Other | No. of Containers by Preservative Type: Unpres | HNO3 | H2SO4 | HCl | NaOH | Na2S2O3 | Other Preserved | PFAS QSM 5.2 Table B-15 | True TOF | TRP Assays | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SB-VRTB-03_116.25-116.5 | 9/14 | 1425 | G | | X | | 1 | | | | | | | X | | | |
| SB-VRTB-03_116.5-17 | 9/14 | 1430 | G | | X | | 3 | | | | | | | X | X | X | grain size sample on separate COC |
| SB-VRTB-03_17-17.5 | 9/14 | 1440 | G | | X | | 1 | | | | | | | X | | | |
| SB-VRTB-03_18-18.5 | 9/14 | 1445 | G | | X | | 1 | | | | | | | X | | | |
| SB-VRTB-03_19-19.5 | 9/14 | 1448 | G | | X | | 3 | | | | | | | X | X | X | grain size sample on separate COC |
| SB-VRTB-03_20.5-21 | 9/14 | 1550 | G | | X | | 2 | | | | | | | X | X | | |
| SB-VRTB-03_22.5-23 | 9/14 | 1555 | G | | X | | 3 | | | | | | | X | X | X | |
| SB-VRTB-03_24-24.5 | 9/14 | 1600 | G | | X | | 1 | | | | | | | X | | | |
| SB-VRTB-03_26-26.5 | 9/15 | 0940 | G | | X | | 3 | | | | | | | X | X | X | grain size sample on separate COC |
| SB-VRTB-03_27-27.5 | 9/15 | 0950 | G | | X | | 1 | | | | | | | X | | | |

**WI18011**
KES2

Turn Around Time Required (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client X Disposal by Lab

Possible Hazard Identification: X Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify): Level II

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by | 9/16 | 1700 | 1. Received by | 9/16 | 1700 |
| 2. Relinquished by | 9/17/21 | 1836 | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: Fedex | 9/18/21 | 0930 | 4. Laboratory received by | 9/18/21 | 0930 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle): (Yes) No Ice Pack — Receipt Temp: 3.1 °C — Temp Blank: Y N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME013N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 125193

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: 248-994-2323 | Quote No. |
| Address: 28550 Cabot Drive Suite 500 | Sampler's Signature: X | Analysis (Attach list if more space is needed) | Page 3 of 3 |
| City: Novi / State: MI / Zip Code: 48377 | Printed Name: Kristen Hasbrouck | | |
| Project Name: ESTLP GAAF | | | |
| Project No.: 30027244 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab/Composite | Matrix: Aqueous | Matrix: Solid | Matrix: Non-Aqueous | No. of Containers by Preservative Type: Unpres. | HNO3 | H2SO4 | HCl | NaOH | SAS VI | Field Filtered | PFAS QSM | True TOF | Top Assay | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SB-VRTB-03 - 30-30.5' | | 1045 | G | | X | | 3 | | | | | | | X | X | X | |
| SB-VRTB-03 - 32-32.5 | | 1048 | G | | X | | 3 | | | | | | | X | | | MS/MSD |
| SB-VRTB-03 - 34-34.5 | | 1052 | G | | X | | 1 | | | | | | | X | | | |
| SB-VRTB-03 - 35-35.5 | | 1146 | G | | X | | 1 | | | | | | | X | | | |
| SB-VRTB-03 - 36-36.5 | | 1142 | G | | X | | 3 | | | | | | | X | X | X | |
| SB-VRTB-DUP-01 | — | — | G | | X | | 2 | | | | | | | X | X | | |
| SB-VRTB-DUP-02 | — | — | G | | X | | 1 | | | | | | | X | | | |

WI18011
KES2

Turn Around Time Required (Prior lab approval required for expedited TAT): X Standard / Rush (Specify)

Sample Disposal: ☐ Return to Client / X Disposal by Lab

Possible Hazard Identification: X Non-Hazard / ☐ Flammable / ☐ Skin Irritant / ☐ Poison / ☐ Unknown

QC Requirements (Specify): Level II

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by | 9/16 | 1720 | 1. Received by | 9/16 | 1720 |
| 2. Relinquished by | 9/17 | 1036 | 2. Received by | | |
| 3. Relinquished by | | | 3. Received by | | |
| 4. Relinquished by: Fedex | 9/18/24 | 0930 | 4. Laboratory received by | 9/18/24 | 0930 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle): (Yes) No Ice Pack — Receipt Temp: 3.1 °C — Temp Blank: Y / N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical

**Samples Receipt Checklist (SRC) (ME0018C-15)**
Issuing Authority: Pace ENV - WCOL

Revised: 9/29/2020


# Sample Receipt Checklist (SRC)

Client: PACE  Cooler Inspected by/date: JRG2 / 09/18/2021  Lot #: WI18011

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☐ Yes | ☑ No | | 1. Were custody seals present on the cooler? |
| ☐ Yes | ☐ No | ☑ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: 21-1928

3.1 / 3.1 °C  NA / NA °C  NA / NA °C  NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles  IR Gun ID: 5  IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☐ Yes | ☐ No | ☑ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☐ Yes | ☑ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS? |
| ☑ Yes | ☐ No | | 21. Was the quote number listed on the container label? If yes, Quote # 25221 |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L. (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2  Date: 09/18/2021

Comments:

*LELAP CERTIFICATE NUMBER: 01955*
*DOD-ELAP ACCREDITATION NUMBER: 74960*

# ANALYTICAL RESULTS

**PERFORMED BY**

**Pace Analytical Gulf Coast**
**7979 Innovation Park Dr.**
**Baton Rouge, LA 70820**
**(225) 769-4900**

**Report Date** 11/09/2021

**Report #** 221101713

***Project*** WI18011/ESTCP GAAF

**Samples Collected** 9/14/21 - 9/15/21

| ***Deliver To*** | ***Additional Recipients*** |
|---|---|
| Kathy Smith<br>Pace Analytical<br>106 Vantage Point Drive<br>Columbia, SC 29223<br>803-227-2704 | NONE |

# Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with Pace Gulf Coast's Standard Operating Procedures.

**Common Abbreviations that may be Utilized in this Report**

| | |
|---|---|
| **ND** | Indicates the result was Not Detected at the specified reporting limit |
| **NO** | Indicates the sample did not ignite when preliminary test performed for EPA Method 1030 |
| **DO** | Indicates the result was Diluted Out |
| **MI** | Indicates the result was subject to Matrix Interference |
| **TNTC** | Indicates the result was Too Numerous To Count |
| **SUBC** | Indicates the analysis was Sub-Contracted |
| **FLD** | Indicates the analysis was performed in the Field |
| **DL** | Detection Limit |
| **LOD** | Limit of Detection |
| **LOQ** | Limit of Quantitation |
| **RE** | Re-analysis |
| **CF** | HPLC or GC Confirmation |
| **00:01** | Reported as a time equivalent to 12:00 AM |

**Reporting Flags that may be Utilized in this Report**

| | |
|---|---|
| **J or I** | Indicates the result is between the MDL and LOQ |
| **J** | DOD flag on analyte in the parent sample for MS/MSD outside acceptance criteria |
| **U** | Indicates the compound was analyzed for but not detected |
| **B or V** | Indicates the analyte was detected in the associated Method Blank |
| **Q** | Indicates a non-compliant QC Result (See Q Flag Application Report) |
| ***** | Indicates a non-compliant or not applicable QC recovery or RPD – see narrative |
| **E** | Organics **-** The result is estimated because it exceeded the instrument calibration range |
| **E** | Metals - % diference for the serial dilution is > 10% |
| **L** | Reporting Limits adjusted to meet risk-based limit. |
| **P** | RPD between primary and confirmation result is greater than 40 |
| **DL** | Diluted analysis – when appended to Client Sample ID |

Sample receipt at Pace Gulf Coast is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of Pace Gulf Coast. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with The NELAC Institute (TNI) Standard 2009 and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.



Authorized Signature
Pace Gulf Coast Report 221101713

# Certifications

| Certification | Certification Number |
|---|---|
| DOD ELAP | 74960 |
| Alabama | 01955 |
| Arkansas | 88-0655 |
| Colorado | 01955 |
| Delaware | 01955 |
| Florida | E87854 |
| Georgia | 01955 |
| Hawaii | 01955 |
| Idaho | 01955 |
| Illinois | 200048 |
| Indiana | 01955 |
| Kansas | E-10354 |
| Kentucky | 95 |
| Louisiana | 01955 |
| Maryland | 01955 |
| Massachusetts | 01955 |
| Michigan | 01955 |
| Mississippi | 01955 |
| Missouri | 01955 |
| Montana | N/A |
| Nebraska | 01955 |
| New Mexico | 01955 |
| North Carolina | 618 |
| North Dakota | R-195 |
| Oklahoma | 9403 |
| South Carolina | 73006001 |
| South Dakota | 01955 |
| Tennessee | 01955 |
| Texas | T104704178 |
| Vermont | 01955 |
| Virginia | 460215 |
| Washington | C929 |
| USDA Soil Permit | P330-16-00234 |

# Case Narrative

**Client:** Pace Analytical Services **Report:** 221101713

Pace Analytical Gulf Coast received and analyzed the sample(s) listed on the Report Sample Summary page of this report. Receipt of the sample(s) is documented by the attached chain of custody. This applies only to the sample(s) listed in this report. No sample integrity or quality control exceptions were identified unless noted below.

This report was completed in accordance with DOD QSM 5.3 as specified in the contract.

**No anomalies were found for the analyzed sample(s).**

# Sample Summary

| Lab ID | Client ID | Matrix | Collect Date | Receive Date |
|---|---|---|---|---|
| 22110171301 | SB-VRTB-03_13.75-14 | Solid | 9/14/21 12:40 | 10/14/21 11:00 |
| 22110171302 | SB-VRTB-03_14.75-15 | Solid | 9/14/21 12:50 | 10/14/21 11:00 |
| 22110171303 | SB-VRTB-03_16.5-17 | Solid | 9/14/21 14:30 | 10/14/21 11:00 |
| 22110171304 | SB-VRTB-03_19-19.5 | Solid | 9/14/21 14:48 | 10/14/21 11:00 |
| 22110171305 | SB-VRTB-03_22.5-23 | Solid | 9/14/21 15:55 | 10/14/21 11:00 |
| 22110171306 | SB-VRTB-03_26-26.5 | Solid | 9/15/21 09:04 | 10/14/21 11:00 |
| 22110171307 | SB-VRTB-03_30-30.5 | Solid | 9/15/21 10:45 | 10/14/21 11:00 |
| 22110171308 | SB-VRTB-03_36-36.5 | Solid | 9/15/21 11:42 | 10/14/21 11:00 |

# Test Summary

**SM 2540 G-2011**

| Lab ID | Client ID | Matrix | Batch | Instru | RunDate |
|---|---|---|---|---|---|
| 22110171301 | SB-VRTB-03_13.75-14 | Solid | 726076 | BAL02 | 11/08/21 15:24 |
| 22110171302 | SB-VRTB-03_14.75-15 | Solid | 726076 | BAL02 | 11/08/21 15:24 |
| 22110171303 | SB-VRTB-03_16.5-17 | Solid | 726076 | BAL02 | 11/08/21 15:24 |
| 22110171304 | SB-VRTB-03_19-19.5 | Solid | 726076 | BAL02 | 11/08/21 15:24 |
| 22110171305 | SB-VRTB-03_22.5-23 | Solid | 726076 | BAL02 | 11/08/21 15:24 |
| 22110171306 | SB-VRTB-03_26-26.5 | Solid | 726076 | BAL02 | 11/08/21 15:24 |
| 22110171307 | SB-VRTB-03_30-30.5 | Solid | 726076 | BAL02 | 11/08/21 15:24 |
| 22110171308 | SB-VRTB-03_36-36.5 | Solid | 726076 | BAL02 | 11/08/21 15:24 |

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Matrix | Batch | Instru | RunDate |
|---|---|---|---|---|---|
| 22110171301 | SB-VRTB-03_13.75-14 | Solid | 724445 | QQQ4 | 10/22/21 03:13 |
| 22110171302 | SB-VRTB-03_14.75-15 | Solid | 724445 | QQQ4 | 10/22/21 03:28 |
| 22110171303 | SB-VRTB-03_16.5-17 | Solid | 724445 | QQQ4 | 10/22/21 03:43 |
| 22110171304 | SB-VRTB-03_19-19.5 | Solid | 724445 | QQQ4 | 10/22/21 03:57 |
| 22110171305 | SB-VRTB-03_22.5-23 | Solid | 724445 | QQQ4 | 10/22/21 04:12 |
| 22110171306 | SB-VRTB-03_26-26.5 | Solid | 724445 | QQQ4 | 10/22/21 04:27 |
| 22110171307 | SB-VRTB-03_30-30.5 | Solid | 724445 | QQQ4 | 10/22/21 04:42 |
| 22110171308 | SB-VRTB-03_36-36.5 | Solid | 724445 | QQQ4 | 10/22/21 04:57 |

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Matrix | Batch | Instru | RunDate |
|---|---|---|---|---|---|
| 22110171301 | SB-VRTB-03_13.75-14 | Solid | 724594 | QQQ3 | 10/25/21 18:20 |
| 22110171302 | SB-VRTB-03_14.75-15 | Solid | 724594 | QQQ3 | 10/25/21 18:35 |
| 22110171303 | SB-VRTB-03_16.5-17 | Solid | 724594 | QQQ3 | 10/25/21 18:50 |
| 22110171304 | SB-VRTB-03_19-19.5 | Solid | 724594 | QQQ3 | 10/25/21 19:04 |
| 22110171305 | SB-VRTB-03_22.5-23 | Solid | 724594 | QQQ3 | 10/25/21 19:19 |
| 22110171306 | SB-VRTB-03_26-26.5 | Solid | 725464 | QQQ3 | 11/02/21 19:47 |
| 22110171307 | SB-VRTB-03_30-30.5 | Solid | 724594 | QQQ3 | 10/25/21 19:48 |
| 22110171308 | SB-VRTB-03_36-36.5 | Solid | 725464 | QQQ3 | 11/02/21 20:02 |

# Manual Integrations

Manual Integrations for LC and IC (if performed) are documented in the raw data.
No other manual integrations were performed by Pace Gulf Coast.

# Q Flag Summary

NO Q FLAGS FOR THIS WORKORDER

# Detect Summary

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22110171301 | SB-VRTB-03_13.75-14 | Perfluorohexanoic acid (PFHxA) | ug/Kg | 0.021J | 1 | 2.26 |
| 22110171301 | SB-VRTB-03_13.75-14 | Perfluoropentanoic acid (PFPeA) | ug/Kg | 0.030J | 1 | 2.26 |
| 22110171302 | SB-VRTB-03_14.75-15 | Perfluorobutanoic acid (PFBA) | ug/Kg | 0.296J | 1 | 2.24 |
| 22110171302 | SB-VRTB-03_14.75-15 | Perfluoroheptanoic acid (PFHpA) | ug/Kg | 0.090J | 1 | 2.24 |
| 22110171302 | SB-VRTB-03_14.75-15 | Perfluorohexanesulfonic acid (PFHxS) | ug/Kg | 0.035J | 1 | 2.24 |
| 22110171302 | SB-VRTB-03_14.75-15 | Perfluorohexanoic acid (PFHxA) | ug/Kg | 0.193J | 1 | 2.24 |
| 22110171302 | SB-VRTB-03_14.75-15 | Perfluoropentanoic acid (PFPeA) | ug/Kg | 0.644J | 1 | 2.24 |
| 22110171303 | SB-VRTB-03_16.5-17 | Perfluorobutanoic acid (PFBA) | ug/Kg | 0.046J | 1 | 8.45 |
| 22110171303 | SB-VRTB-03_16.5-17 | Perfluoroheptanoic acid (PFHpA) | ug/Kg | 0.024J | 1 | 8.45 |
| 22110171303 | SB-VRTB-03_16.5-17 | Perfluorohexanesulfonic acid (PFHxS) | ug/Kg | 0.174J | 1 | 8.45 |
| 22110171303 | SB-VRTB-03_16.5-17 | Perfluorohexanoic acid (PFHxA) | ug/Kg | 0.225J | 1 | 8.45 |
| 22110171303 | SB-VRTB-03_16.5-17 | Perfluorooctanesulfonic acid (PFOS) | ug/Kg | 2.37 | 1 | 8.45 |
| 22110171303 | SB-VRTB-03_16.5-17 | Perfluoropentanoic acid (PFPeA) | ug/Kg | 0.084J | 1 | 8.45 |
| 22110171304 | SB-VRTB-03_19-19.5 | Perfluorobutanoic acid (PFBA) | ug/Kg | 0.047J | 1 | 8.54 |
| 22110171304 | SB-VRTB-03_19-19.5 | Perfluoroheptanesulfonic acid (PFHpS) | ug/Kg | 0.023J | 1 | 8.54 |
| 22110171304 | SB-VRTB-03_19-19.5 | Perfluoroheptanoic acid (PFHpA) | ug/Kg | 0.037J | 1 | 8.54 |
| 22110171304 | SB-VRTB-03_19-19.5 | Perfluorohexanesulfonic acid (PFHxS) | ug/Kg | 0.161J | 1 | 8.54 |
| 22110171304 | SB-VRTB-03_19-19.5 | Perfluorohexanoic acid (PFHxA) | ug/Kg | 0.302J | 1 | 8.54 |
| 22110171304 | SB-VRTB-03_19-19.5 | Perfluorooctanesulfonic acid (PFOS) | ug/Kg | 5.07 | 1 | 8.54 |
| 22110171304 | SB-VRTB-03_19-19.5 | Perfluoropentanoic acid (PFPeA) | ug/Kg | 0.104J | 1 | 8.54 |
| 22110171305 | SB-VRTB-03_22.5-23 | Perfluorobutanoic acid (PFBA) | ug/Kg | 0.055J | 1 | 9.99 |
| 22110171305 | SB-VRTB-03_22.5-23 | Perfluoroheptanesulfonic acid (PFHpS) | ug/Kg | 0.038J | 1 | 9.99 |
| 22110171305 | SB-VRTB-03_22.5-23 | Perfluoroheptanoic acid (PFHpA) | ug/Kg | 0.038J | 1 | 9.99 |
| 22110171305 | SB-VRTB-03_22.5-23 | Perfluorohexanesulfonic acid (PFHxS) | ug/Kg | 0.196J | 1 | 9.99 |
| 22110171305 | SB-VRTB-03_22.5-23 | Perfluorohexanoic acid (PFHxA) | ug/Kg | 0.290J | 1 | 9.99 |
| 22110171305 | SB-VRTB-03_22.5-23 | Perfluorooctanesulfonic acid (PFOS) | ug/Kg | 10.3 | 1 | 9.99 |
| 22110171305 | SB-VRTB-03_22.5-23 | Perfluoropentanoic acid (PFPeA) | ug/Kg | 0.114J | 1 | 9.99 |
| 22110171306 | SB-VRTB-03_26-26.5 | Perfluorooctanesulfonic acid (PFOS) | ug/Kg | 0.062J | 1 | 13.16 |
| 22110171307 | SB-VRTB-03_30-30.5 | Perfluorohexanesulfonic acid (PFHxS) | ug/Kg | 0.043J | 1 | 9.45 |
| 22110171307 | SB-VRTB-03_30-30.5 | Perfluorohexanoic acid (PFHxA) | ug/Kg | 0.035J | 1 | 9.45 |
| 22110171307 | SB-VRTB-03_30-30.5 | Perfluorooctanesulfonic acid (PFOS) | ug/Kg | 0.641J | 1 | 9.45 |
| 22110171307 | SB-VRTB-03_30-30.5 | Perfluoropentanoic acid (PFPeA) | ug/Kg | 0.027J | 1 | 9.45 |

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22110171303 | SB-VRTB-03_16.5-17 | Perfluorohexanesulfonic acid (PFHxS) | ug/Kg | 0.086J | 1 | 8.45 |
| 22110171303 | SB-VRTB-03_16.5-17 | Perfluorooctanesulfonic acid (PFOS) | ug/Kg | 1.35 | 1 | 8.45 |
| 22110171304 | SB-VRTB-03_19-19.5 | Perfluoroheptanesulfonic acid (PFHpS) | ug/Kg | 0.053J | 1 | 8.54 |
| 22110171304 | SB-VRTB-03_19-19.5 | Perfluorohexanesulfonic acid (PFHxS) | ug/Kg | 0.152J | 1 | 8.54 |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22110171304 | SB-VRTB-03_19-19.5 | Perfluorohexanoic acid (PFHxA) | ug/Kg | 0.024J | 1 | 8.54 |
| 22110171304 | SB-VRTB-03_19-19.5 | Perfluorooctanesulfonic acid (PFOS) | ug/Kg | 5.62 | 1 | 8.54 |
| 22110171305 | SB-VRTB-03_22.5-23 | Perfluorohexanesulfonic acid (PFHxS) | ug/Kg | 0.062J | 1 | 9.99 |
| 22110171305 | SB-VRTB-03_22.5-23 | Perfluorooctanesulfonic acid (PFOS) | ug/Kg | 3.78 | 1 | 9.99 |
| 22110171306 | SB-VRTB-03_26-26.5 | Perfluorooctanesulfonic acid (PFOS) | ug/Kg | 0.171J | 1 | 13.16 |
| 22110171307 | SB-VRTB-03_30-30.5 | Perfluorooctanesulfonic acid (PFOS) | ug/Kg | 0.387J | 1 | 9.45 |

# Sample Results

| **SB-VRTB-03_13.75-14** | **Collect Date** | 09/14/2021 12:40 | **Lab ID** | 22110171301 |
|---|---|---|---|---|
| | **Receive Date** | 10/14/2021 11:00 | **Matrix** | Solid |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/19/21 15:48 | 724063 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/22/21 03:13 | 724445 | RXJ | 2.26 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.204U | 0.051 | 0.204 | 1.02 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.204U | 0.061 | 0.204 | 1.02 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 919005-14-4 | ADONA | 0.051U | 0.010 | 0.051 | 1.02 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.511U | 0.143 | 0.511 | 2.04 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.102U | 0.041 | 0.102 | 1.02 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.102U | 0.041 | 0.102 | 1.02 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 355-46-4 | Perfluorohexanesulfonic acid (PFHxS) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 1763-23-1 | Perfluorooctanesulfonic acid (PFOS) | 0.204U | 0.051 | 0.204 | 1.02 | ug/Kg |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.204U | 0.082 | 0.204 | 1.02 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 4.99 | 5.32 | ug/Kg | 107 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 99.80 | 88.1 | ug/Kg | 88 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 99.80 | 91.5 | ug/Kg | 92 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 99.80 | 90 | ug/Kg | 90 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 99.80 | 84.5 | ug/Kg | 85 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 99.80 | 85.3 | ug/Kg | 85 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 99.80 | 93.2 | ug/Kg | 93 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 99.80 | 110 | ug/Kg | 110 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 99.80 | 93.3 | ug/Kg | 93 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 99.80 | 95.4 | ug/Kg | 96 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 99.80 | 96.9 | ug/Kg | 97 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 99.80 | 99.1 | ug/Kg | 99 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 99.80 | 97.4 | ug/Kg | 98 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 99.80 | 97.2 | ug/Kg | 97 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 99.80 | 97 | ug/Kg | 97 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 99.80 | 85 | ug/Kg | 85 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 99.80 | 99.1 | ug/Kg | 99 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 99.80 | 97.7 | ug/Kg | 98 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 99.80 | 99.1 | ug/Kg | 99 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 99.80 | 94.5 | ug/Kg | 95 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 99.80 | 93.6 | ug/Kg | 94 | 50 - 150 |

# Sample Results

## SB-VRTB-03_13.75-14

| | | | |
|---|---|---|---|
| **Collect Date** | 09/14/2021 12:40 | **Lab ID** | 22110171301 |
| **Receive Date** | 10/14/2021 11:00 | **Matrix** | Solid |

## PFAS Top Assay QSM B15 (Post)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/20/21 19:50 | 724306 | PFAS Top Assay QSM B15 (Post) | 1 | 10/25/21 18:20 | 724594 | ADA | 2.26 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.205U | 0.051 | 0.205 | 1.02 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.205U | 0.061 | 0.205 | 1.02 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 919005-14-4 | ADONA | 0.051U | 0.010 | 0.051 | 1.02 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.512U | 0.143 | 0.512 | 2.05 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.102U | 0.041 | 0.102 | 1.02 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.102U | 0.041 | 0.102 | 1.02 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 355-46-4 | Perfluorohexanesulfonic acid (PFHxS) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| **307-24-4** | **Perfluorohexanoic acid (PFHxA)** | **0.021J** | **0.020** | **0.051** | **1.02** | **ug/Kg** |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 1763-23-1 | Perfluorooctanesulfonic acid (PFOS) | 0.205U | 0.051 | 0.205 | 1.02 | ug/Kg |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.205U | 0.082 | 0.205 | 1.02 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| **2706-90-3** | **Perfluoropentanoic acid (PFPeA)** | **0.030J** | **0.020** | **0.051** | **1.02** | **ug/Kg** |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 5 | 4.29 | ug/Kg | 86 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 100 | 68.3 | ug/Kg | 68 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 100 | 73.9 | ug/Kg | 74 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 100 | 80.4 | ug/Kg | 80 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 100 | 75.7 | ug/Kg | 76 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 100 | 80.5 | ug/Kg | 80 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 100 | 68.3 | ug/Kg | 68 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 100 | 76.2 | ug/Kg | 76 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 100 | 79.4 | ug/Kg | 79 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 100 | 80.6 | ug/Kg | 81 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 100 | 75.1 | ug/Kg | 75 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 100 | 75.9 | ug/Kg | 76 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 100 | 73.3 | ug/Kg | 73 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 100 | 78 | ug/Kg | 78 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 100 | 72.5 | ug/Kg | 72 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 100 | 72.6 | ug/Kg | 73 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 100 | 76 | ug/Kg | 76 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 100 | 81.6 | ug/Kg | 82 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 100 | 76.8 | ug/Kg | 77 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 100 | 71.8 | ug/Kg | 72 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 100 | 70.8 | ug/Kg | 71 | 50 - 150 |

# Sample Results

## SB-VRTB-03_14.75-15

| | | | |
|---|---|---|---|
| **Collect Date** | 09/14/2021 12:50 | **Lab ID** | 22110171302 |
| **Receive Date** | 10/14/2021 11:00 | **Matrix** | Solid |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/19/21 15:48 | 724063 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/22/21 03:28 | 724445 | RXJ | 2.24 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.195U | 0.049 | 0.195 | 0.974 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.195U | 0.058 | 0.195 | 0.974 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.097U | 0.029 | 0.097 | 0.974 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.097U | 0.029 | 0.097 | 0.974 | ug/Kg |
| 919005-14-4 | ADONA | 0.049U | 0.00974 | 0.049 | 0.974 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.097U | 0.029 | 0.097 | 0.974 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.487U | 0.136 | 0.487 | 1.95 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.097U | 0.039 | 0.097 | 0.974 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.097U | 0.029 | 0.097 | 0.974 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.097U | 0.039 | 0.097 | 0.974 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 355-46-4 | Perfluorohexanesulfonic acid (PFHxS) | 0.097U | 0.029 | 0.097 | 0.974 | ug/Kg |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.097U | 0.029 | 0.097 | 0.974 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 1763-23-1 | Perfluorooctanesulfonic acid (PFOS) | 0.195U | 0.049 | 0.195 | 0.974 | ug/Kg |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.195U | 0.078 | 0.195 | 0.974 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.097U | 0.029 | 0.097 | 0.974 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.049U | 0.019 | 0.049 | 0.974 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 4.76 | 5.18 | ug/Kg | 109 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 95.20 | 86.4 | ug/Kg | 91 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 95.20 | 87.7 | ug/Kg | 92 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 95.20 | 86.3 | ug/Kg | 91 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 95.20 | 88.1 | ug/Kg | 93 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 95.20 | 83.4 | ug/Kg | 88 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 95.20 | 89.6 | ug/Kg | 94 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 95.20 | 108 | ug/Kg | 114 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 95.20 | 91.9 | ug/Kg | 96 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 95.20 | 92.6 | ug/Kg | 97 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 95.20 | 94.4 | ug/Kg | 99 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 95.20 | 97.5 | ug/Kg | 102 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 95.20 | 95.1 | ug/Kg | 100 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 95.20 | 95.3 | ug/Kg | 100 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 95.20 | 94 | ug/Kg | 99 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 95.20 | 83.2 | ug/Kg | 87 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 95.20 | 96.5 | ug/Kg | 101 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 95.20 | 94 | ug/Kg | 99 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 95.20 | 96.6 | ug/Kg | 101 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 95.20 | 93.2 | ug/Kg | 98 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 95.20 | 90.4 | ug/Kg | 95 | 50 - 150 |

# Sample Results

| SB-VRTB-03_14.75-15 | | | | |
|---|---|---|---|---|
| | Collect Date | 09/14/2021 12:50 | Lab ID | 22110171302 |
| | Receive Date | 10/14/2021 11:00 | Matrix | Solid |

## PFAS Top Assay QSM B15 (Post)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/20/21 19:50 | 724306 | PFAS Top Assay QSM B15 (Post) | 1 | 10/25/21 18:35 | 724594 | ADA | 2.24 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.203U | 0.051 | 0.203 | 1.02 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.203U | 0.061 | 0.203 | 1.02 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 919005-14-4 | ADONA | 0.051U | 0.010 | 0.051 | 1.02 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.508U | 0.142 | 0.508 | 2.03 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| **375-22-4** | **Perfluorobutanoic acid (PFBA)** | **0.296J** | **0.041** | **0.102** | **1.02** | **ug/Kg** |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.102U | 0.041 | 0.102 | 1.02 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| **375-85-9** | **Perfluoroheptanoic acid (PFHpA)** | **0.090J** | **0.020** | **0.051** | **1.02** | **ug/Kg** |
| **355-46-4** | **Perfluorohexanesulfonic acid (PFHxS)** | **0.035J** | **0.031** | **0.102** | **1.02** | **ug/Kg** |
| **307-24-4** | **Perfluorohexanoic acid (PFHxA)** | **0.193J** | **0.020** | **0.051** | **1.02** | **ug/Kg** |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 1763-23-1 | Perfluorooctanesulfonic acid (PFOS) | 0.203U | 0.051 | 0.203 | 1.02 | ug/Kg |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.203U | 0.081 | 0.203 | 1.02 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| **2706-90-3** | **Perfluoropentanoic acid (PFPeA)** | **0.644J** | **0.020** | **0.051** | **1.02** | **ug/Kg** |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.102U | 0.031 | 0.102 | 1.02 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.051U | 0.020 | 0.051 | 1.02 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 4.97 | 3.95 | ug/Kg | 79 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 99.40 | 62.9 | ug/Kg | 63 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 99.40 | 69.7 | ug/Kg | 70 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 99.40 | 73.3 | ug/Kg | 74 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 99.40 | 69.8 | ug/Kg | 70 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 99.40 | 76.6 | ug/Kg | 77 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 99.40 | 62.4 | ug/Kg | 63 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 99.40 | 72 | ug/Kg | 72 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 99.40 | 75.3 | ug/Kg | 76 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 99.40 | 75.1 | ug/Kg | 76 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 99.40 | 71.1 | ug/Kg | 72 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 99.40 | 71.8 | ug/Kg | 72 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 99.40 | 70.6 | ug/Kg | 71 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 99.40 | 73.5 | ug/Kg | 74 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 99.40 | 69.3 | ug/Kg | 70 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 99.40 | 72.1 | ug/Kg | 73 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 99.40 | 73.7 | ug/Kg | 74 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 99.40 | 76.5 | ug/Kg | 77 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 99.40 | 73.5 | ug/Kg | 74 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 99.40 | 69.7 | ug/Kg | 70 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 99.40 | 67.7 | ug/Kg | 68 | 50 - 150 |

# Sample Results

## SB-VRTB-03_16.5-17

| | | | |
|---|---|---|---|
| **Collect Date** | 09/14/2021 14:30 | **Lab ID** | 22110171303 |
| **Receive Date** | 10/14/2021 11:00 | **Matrix** | Solid |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/19/21 15:48 | 724063 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/22/21 03:43 | 724445 | RXJ | 8.45 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.218U | 0.055 | 0.218 | 1.09 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.218U | 0.065 | 0.218 | 1.09 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 919005-14-4 | ADONA | 0.055U | 0.011 | 0.055 | 1.09 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.545U | 0.153 | 0.545 | 2.18 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.109U | 0.044 | 0.109 | 1.09 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.109U | 0.044 | 0.109 | 1.09 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| **355-46-4** | **Perfluorohexanesulfonic acid (PFHxS)** | **0.086J** | **0.033** | **0.109** | **1.09** | **ug/Kg** |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| **1763-23-1** | **Perfluorooctanesulfonic acid (PFOS)** | **1.35** | **0.055** | **0.218** | **1.09** | **ug/Kg** |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.218U | 0.087 | 0.218 | 1.09 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 4.99 | 5.86 | ug/Kg | 117 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 99.80 | 94.7 | ug/Kg | 95 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 99.80 | 108 | ug/Kg | 108 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 99.80 | 111 | ug/Kg | 111 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 99.80 | 116 | ug/Kg | 116 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 99.80 | 102 | ug/Kg | 102 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 99.80 | 110 | ug/Kg | 110 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 99.80 | 114 | ug/Kg | 115 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 99.80 | 100 | ug/Kg | 100 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 99.80 | 104 | ug/Kg | 104 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 99.80 | 105 | ug/Kg | 106 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 99.80 | 106 | ug/Kg | 106 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 99.80 | 105 | ug/Kg | 106 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 99.80 | 109 | ug/Kg | 109 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 99.80 | 113 | ug/Kg | 113 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 99.80 | 106 | ug/Kg | 106 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 99.80 | 108 | ug/Kg | 108 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 99.80 | 103 | ug/Kg | 104 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 99.80 | 106 | ug/Kg | 106 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 99.80 | 100 | ug/Kg | 101 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 99.80 | 129 | ug/Kg | 129 | 50 - 150 |

# Sample Results

| SB-VRTB-03_16.5-17 | | | | |
|---|---|---|---|---|
| | Collect Date | 09/14/2021 14:30 | Lab ID | 22110171303 |
| | Receive Date | 10/14/2021 11:00 | Matrix | Solid |

## PFAS Top Assay QSM B15 (Post)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/20/21 19:50 | 724306 | PFAS Top Assay QSM B15 (Post) | 1 | 10/25/21 18:50 | 724594 | ADA | 8.45 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.218U | 0.055 | 0.218 | 1.09 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.218U | 0.066 | 0.218 | 1.09 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 919005-14-4 | ADONA | 0.055U | 0.011 | 0.055 | 1.09 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.546U | 0.153 | 0.546 | 2.18 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| **375-22-4** | **Perfluorobutanoic acid (PFBA)** | **0.046J** | **0.044** | **0.109** | **1.09** | **ug/Kg** |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.109U | 0.044 | 0.109 | 1.09 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| **375-85-9** | **Perfluoroheptanoic acid (PFHpA)** | **0.024J** | **0.022** | **0.055** | **1.09** | **ug/Kg** |
| **355-46-4** | **Perfluorohexanesulfonic acid (PFHxS)** | **0.174J** | **0.033** | **0.109** | **1.09** | **ug/Kg** |
| **307-24-4** | **Perfluorohexanoic acid (PFHxA)** | **0.225J** | **0.022** | **0.055** | **1.09** | **ug/Kg** |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| **1763-23-1** | **Perfluorooctanesulfonic acid (PFOS)** | **2.37** | **0.055** | **0.218** | **1.09** | **ug/Kg** |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.218U | 0.087 | 0.218 | 1.09 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| **2706-90-3** | **Perfluoropentanoic acid (PFPeA)** | **0.084J** | **0.022** | **0.055** | **1.09** | **ug/Kg** |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.109U | 0.033 | 0.109 | 1.09 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.055U | 0.022 | 0.055 | 1.09 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 5 | 4.11 | ug/Kg | 82 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 100 | 63 | ug/Kg | 63 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 100 | 71.8 | ug/Kg | 72 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 100 | 78.2 | ug/Kg | 78 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 100 | 78.9 | ug/Kg | 79 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 100 | 75.2 | ug/Kg | 75 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 100 | 69.3 | ug/Kg | 69 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 100 | 74.1 | ug/Kg | 74 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 100 | 79.1 | ug/Kg | 79 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 100 | 78.4 | ug/Kg | 78 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 100 | 72.8 | ug/Kg | 73 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 100 | 72.6 | ug/Kg | 73 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 100 | 71.5 | ug/Kg | 72 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 100 | 75.3 | ug/Kg | 75 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 100 | 72.2 | ug/Kg | 72 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 100 | 71.6 | ug/Kg | 72 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 100 | 74.6 | ug/Kg | 75 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 100 | 77.5 | ug/Kg | 78 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 100 | 72.6 | ug/Kg | 73 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 100 | 69.9 | ug/Kg | 70 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 100 | 71.6 | ug/Kg | 72 | 50 - 150 |

# Sample Results

| SB-VRTB-03_19-19.5 | | | | |
|---|---|---|---|---|
| | Collect Date | 09/14/2021 14:48 | Lab ID | 22110171304 |
| | Receive Date | 10/14/2021 11:00 | Matrix | Solid |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/19/21 15:48 | 724063 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/22/21 03:57 | 724445 | RXJ | 8.54 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.053U | 0.021 | 0.053 | 1.07 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.213U | 0.053 | 0.213 | 1.07 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.213U | 0.064 | 0.213 | 1.07 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.107U | 0.032 | 0.107 | 1.07 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.107U | 0.032 | 0.107 | 1.07 | ug/Kg |
| 919005-14-4 | ADONA | 0.053U | 0.011 | 0.053 | 1.07 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.107U | 0.032 | 0.107 | 1.07 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.053U | 0.021 | 0.053 | 1.07 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.533U | 0.149 | 0.533 | 2.13 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.053U | 0.021 | 0.053 | 1.07 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.107U | 0.043 | 0.107 | 1.07 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.107U | 0.032 | 0.107 | 1.07 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.107U | 0.043 | 0.107 | 1.07 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.053U | 0.021 | 0.053 | 1.07 | ug/Kg |
| **375-92-8** | **Perfluoroheptanesulfonic acid (PFHpS)** | **0.053J** | **0.021** | **0.053** | **1.07** | **ug/Kg** |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.053U | 0.021 | 0.053 | 1.07 | ug/Kg |
| **355-46-4** | **Perfluorohexanesulfonic acid (PFHxS)** | **0.152J** | **0.032** | **0.107** | **1.07** | **ug/Kg** |
| **307-24-4** | **Perfluorohexanoic acid (PFHxA)** | **0.024J** | **0.021** | **0.053** | **1.07** | **ug/Kg** |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.107U | 0.032 | 0.107 | 1.07 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.053U | 0.021 | 0.053 | 1.07 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.053U | 0.021 | 0.053 | 1.07 | ug/Kg |
| **1763-23-1** | **Perfluorooctanesulfonic acid (PFOS)** | **5.62** | **0.053** | **0.213** | **1.07** | **ug/Kg** |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.213U | 0.085 | 0.213 | 1.07 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.053U | 0.021 | 0.053 | 1.07 | ug/Kg |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 0.053U | 0.021 | 0.053 | 1.07 | ug/Kg |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.053U | 0.021 | 0.053 | 1.07 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.107U | 0.032 | 0.107 | 1.07 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.053U | 0.021 | 0.053 | 1.07 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 4.87 | 5.49 | ug/Kg | 113 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 97.50 | 91.5 | ug/Kg | 94 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 97.50 | 100 | ug/Kg | 103 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 97.50 | 113 | ug/Kg | 116 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 97.50 | 117 | ug/Kg | 120 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 97.50 | 106 | ug/Kg | 108 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 97.50 | 106 | ug/Kg | 108 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 97.50 | 109 | ug/Kg | 112 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 97.50 | 96.7 | ug/Kg | 99 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 97.50 | 97.1 | ug/Kg | 100 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 97.50 | 99.4 | ug/Kg | 102 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 97.50 | 101 | ug/Kg | 103 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 97.50 | 99.4 | ug/Kg | 102 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 97.50 | 102 | ug/Kg | 105 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 97.50 | 104 | ug/Kg | 107 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 97.50 | 99.9 | ug/Kg | 102 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 97.50 | 104 | ug/Kg | 106 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 97.50 | 96.7 | ug/Kg | 99 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 97.50 | 102 | ug/Kg | 104 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 97.50 | 94.7 | ug/Kg | 97 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 97.50 | 127 | ug/Kg | 130 | 50 - 150 |

# Sample Results

| SB-VRTB-03_19-19.5 | | | | |
|---|---|---|---|---|
| | Collect Date | 09/14/2021 14:48 | Lab ID | 22110171304 |
| | Receive Date | 10/14/2021 11:00 | Matrix | Solid |

## PFAS Top Assay QSM B15 (Post)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/20/21 19:50 | 724306 | PFAS Top Assay QSM B15 (Post) | 1 | 10/25/21 19:04 | 724594 | ADA | 8.54 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.052U | 0.021 | 0.052 | 1.04 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.208U | 0.052 | 0.208 | 1.04 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.208U | 0.062 | 0.208 | 1.04 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.104U | 0.031 | 0.104 | 1.04 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.104U | 0.031 | 0.104 | 1.04 | ug/Kg |
| 919005-14-4 | ADONA | 0.052U | 0.010 | 0.052 | 1.04 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.104U | 0.031 | 0.104 | 1.04 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.052U | 0.021 | 0.052 | 1.04 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.521U | 0.146 | 0.521 | 2.08 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.052U | 0.021 | 0.052 | 1.04 | ug/Kg |
| **375-22-4** | **Perfluorobutanoic acid (PFBA)** | **0.047J** | **0.042** | **0.104** | **1.04** | **ug/Kg** |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.104U | 0.031 | 0.104 | 1.04 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.104U | 0.042 | 0.104 | 1.04 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.052U | 0.021 | 0.052 | 1.04 | ug/Kg |
| **375-92-8** | **Perfluoroheptanesulfonic acid (PFHpS)** | **0.023J** | **0.021** | **0.052** | **1.04** | **ug/Kg** |
| **375-85-9** | **Perfluoroheptanoic acid (PFHpA)** | **0.037J** | **0.021** | **0.052** | **1.04** | **ug/Kg** |
| **355-46-4** | **Perfluorohexanesulfonic acid (PFHxS)** | **0.161J** | **0.031** | **0.104** | **1.04** | **ug/Kg** |
| **307-24-4** | **Perfluorohexanoic acid (PFHxA)** | **0.302J** | **0.021** | **0.052** | **1.04** | **ug/Kg** |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.104U | 0.031 | 0.104 | 1.04 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.052U | 0.021 | 0.052 | 1.04 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.052U | 0.021 | 0.052 | 1.04 | ug/Kg |
| **1763-23-1** | **Perfluorooctanesulfonic acid (PFOS)** | **5.07** | **0.052** | **0.208** | **1.04** | **ug/Kg** |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.208U | 0.083 | 0.208 | 1.04 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.052U | 0.021 | 0.052 | 1.04 | ug/Kg |
| **2706-90-3** | **Perfluoropentanoic acid (PFPeA)** | **0.104J** | **0.021** | **0.052** | **1.04** | **ug/Kg** |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.052U | 0.021 | 0.052 | 1.04 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.104U | 0.031 | 0.104 | 1.04 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.052U | 0.021 | 0.052 | 1.04 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 4.76 | 3.62 | ug/Kg | 76 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 95.20 | 60.7 | ug/Kg | 64 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 95.20 | 67.1 | ug/Kg | 70 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 95.20 | 73.3 | ug/Kg | 77 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 95.20 | 71.7 | ug/Kg | 75 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 95.20 | 71.6 | ug/Kg | 75 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 95.20 | 65.4 | ug/Kg | 69 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 95.20 | 67.8 | ug/Kg | 71 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 95.20 | 74.8 | ug/Kg | 79 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 95.20 | 73.6 | ug/Kg | 77 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 95.20 | 66.9 | ug/Kg | 70 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 95.20 | 66.9 | ug/Kg | 70 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 95.20 | 65.6 | ug/Kg | 69 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 95.20 | 69.9 | ug/Kg | 73 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 95.20 | 67.2 | ug/Kg | 71 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 95.20 | 65.1 | ug/Kg | 68 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 95.20 | 68.8 | ug/Kg | 72 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 95.20 | 73 | ug/Kg | 77 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 95.20 | 68.2 | ug/Kg | 72 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 95.20 | 64.2 | ug/Kg | 67 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 95.20 | 67.8 | ug/Kg | 71 | 50 - 150 |

# Sample Results

## SB-VRTB-03_22.5-23

| | | | |
|---|---|---|---|
| **Collect Date** | 09/14/2021 15:55 | **Lab ID** | 22110171305 |
| **Receive Date** | 10/14/2021 11:00 | **Matrix** | Solid |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/19/21 15:48 | 724063 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/22/21 04:12 | 724445 | RXJ | 9.99 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.222U | 0.056 | 0.222 | 1.11 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.222U | 0.067 | 0.222 | 1.11 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.111U | 0.033 | 0.111 | 1.11 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.111U | 0.033 | 0.111 | 1.11 | ug/Kg |
| 919005-14-4 | ADONA | 0.056U | 0.011 | 0.056 | 1.11 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.111U | 0.033 | 0.111 | 1.11 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.556U | 0.156 | 0.556 | 2.22 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.111U | 0.044 | 0.111 | 1.11 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.111U | 0.033 | 0.111 | 1.11 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.111U | 0.044 | 0.111 | 1.11 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| **355-46-4** | **Perfluorohexanesulfonic acid (PFHxS)** | **0.062J** | **0.033** | **0.111** | **1.11** | **ug/Kg** |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.111U | 0.033 | 0.111 | 1.11 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| **1763-23-1** | **Perfluorooctanesulfonic acid (PFOS)** | **3.78** | **0.056** | **0.222** | **1.11** | **ug/Kg** |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.222U | 0.089 | 0.222 | 1.11 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.111U | 0.033 | 0.111 | 1.11 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.056U | 0.022 | 0.056 | 1.11 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 5 | 5.61 | ug/Kg | 112 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 100 | 95 | ug/Kg | 95 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 100 | 96.5 | ug/Kg | 96 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 100 | 99.5 | ug/Kg | 99 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 100 | 97.6 | ug/Kg | 98 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 100 | 93.5 | ug/Kg | 93 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 100 | 95.8 | ug/Kg | 96 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 100 | 119 | ug/Kg | 119 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 100 | 101 | ug/Kg | 101 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 100 | 101 | ug/Kg | 101 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 100 | 102 | ug/Kg | 102 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 100 | 105 | ug/Kg | 105 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 100 | 105 | ug/Kg | 105 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 100 | 104 | ug/Kg | 104 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 100 | 103 | ug/Kg | 103 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 100 | 94.4 | ug/Kg | 94 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 100 | 104 | ug/Kg | 104 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 100 | 100 | ug/Kg | 100 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 100 | 104 | ug/Kg | 104 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 100 | 101 | ug/Kg | 101 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 100 | 102 | ug/Kg | 102 | 50 - 150 |

# Sample Results

## SB-VRTB-03_22.5-23

| | | | |
|---|---|---|---|
| **Collect Date** | 09/14/2021 15:55 | **Lab ID** | 22110171305 |
| **Receive Date** | 10/14/2021 11:00 | **Matrix** | Solid |

## PFAS Top Assay QSM B15 (Post)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/20/21 19:50 | 724306 | PFAS Top Assay QSM B15 (Post) | 1 | 10/25/21 19:19 | 724594 | ADA | 9.99 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.221U | 0.055 | 0.221 | 1.10 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.221U | 0.066 | 0.221 | 1.10 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 919005-14-4 | ADONA | 0.055U | 0.011 | 0.055 | 1.10 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.552U | 0.155 | 0.552 | 2.21 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| **375-22-4** | **Perfluorobutanoic acid (PFBA)** | **0.055J** | **0.044** | **0.110** | **1.10** | **ug/Kg** |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.110U | 0.044 | 0.110 | 1.10 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| **375-92-8** | **Perfluoroheptanesulfonic acid (PFHpS)** | **0.038J** | **0.022** | **0.055** | **1.10** | **ug/Kg** |
| **375-85-9** | **Perfluoroheptanoic acid (PFHpA)** | **0.038J** | **0.022** | **0.055** | **1.10** | **ug/Kg** |
| **355-46-4** | **Perfluorohexanesulfonic acid (PFHxS)** | **0.196J** | **0.033** | **0.110** | **1.10** | **ug/Kg** |
| **307-24-4** | **Perfluorohexanoic acid (PFHxA)** | **0.290J** | **0.022** | **0.055** | **1.10** | **ug/Kg** |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| **1763-23-1** | **Perfluorooctanesulfonic acid (PFOS)** | **10.3** | **0.055** | **0.221** | **1.10** | **ug/Kg** |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.221U | 0.088 | 0.221 | 1.10 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| **2706-90-3** | **Perfluoropentanoic acid (PFPeA)** | **0.114J** | **0.022** | **0.055** | **1.10** | **ug/Kg** |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 4.97 | 4.13 | ug/Kg | 83 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 99.40 | 66.8 | ug/Kg | 67 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 99.40 | 72.7 | ug/Kg | 73 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 99.40 | 80.9 | ug/Kg | 81 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 99.40 | 83.5 | ug/Kg | 84 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 99.40 | 77 | ug/Kg | 78 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 99.40 | 64.8 | ug/Kg | 65 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 99.40 | 77 | ug/Kg | 77 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 99.40 | 80.4 | ug/Kg | 81 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 99.40 | 79.4 | ug/Kg | 80 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 99.40 | 75.2 | ug/Kg | 76 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 99.40 | 76 | ug/Kg | 76 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 99.40 | 74.1 | ug/Kg | 75 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 99.40 | 77.5 | ug/Kg | 78 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 99.40 | 73.7 | ug/Kg | 74 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 99.40 | 73.2 | ug/Kg | 74 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 99.40 | 77 | ug/Kg | 77 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 99.40 | 77 | ug/Kg | 77 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 99.40 | 75.6 | ug/Kg | 76 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 99.40 | 72.5 | ug/Kg | 73 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 99.40 | 71.3 | ug/Kg | 72 | 50 - 150 |

# Sample Results

| SB-VRTB-03_26-26.5 | | | | |
|---|---|---|---|---|
| | Collect Date | 09/15/2021 09:04 | Lab ID | 22110171306 |
| | Receive Date | 10/14/2021 11:00 | Matrix | Solid |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/19/21 15:48 | 724063 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/22/21 04:27 | 724445 | RXJ | 13.16 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.230U | 0.058 | 0.230 | 1.15 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.230U | 0.069 | 0.230 | 1.15 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.115U | 0.035 | 0.115 | 1.15 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.115U | 0.035 | 0.115 | 1.15 | ug/Kg |
| 919005-14-4 | ADONA | 0.058U | 0.012 | 0.058 | 1.15 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.115U | 0.035 | 0.115 | 1.15 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.576U | 0.161 | 0.576 | 2.30 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.115U | 0.046 | 0.115 | 1.15 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.115U | 0.035 | 0.115 | 1.15 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.115U | 0.046 | 0.115 | 1.15 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| 355-46-4 | Perfluorohexanesulfonic acid (PFHxS) | 0.115U | 0.035 | 0.115 | 1.15 | ug/Kg |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.115U | 0.035 | 0.115 | 1.15 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| **1763-23-1** | **Perfluorooctanesulfonic acid (PFOS)** | **0.171J** | **0.058** | **0.230** | **1.15** | **ug/Kg** |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.230U | 0.092 | 0.230 | 1.15 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.115U | 0.035 | 0.115 | 1.15 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.058U | 0.023 | 0.058 | 1.15 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 5 | 5.63 | ug/Kg | 113 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 100 | 91.6 | ug/Kg | 92 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 100 | 99 | ug/Kg | 99 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 100 | 108 | ug/Kg | 108 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 100 | 102 | ug/Kg | 102 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 100 | 88.3 | ug/Kg | 88 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 100 | 98.3 | ug/Kg | 98 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 100 | 118 | ug/Kg | 118 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 100 | 98.6 | ug/Kg | 99 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 100 | 98.8 | ug/Kg | 99 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 100 | 101 | ug/Kg | 101 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 100 | 102 | ug/Kg | 102 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 100 | 101 | ug/Kg | 101 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 100 | 102 | ug/Kg | 102 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 100 | 104 | ug/Kg | 104 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 100 | 97.8 | ug/Kg | 98 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 100 | 102 | ug/Kg | 102 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 100 | 99 | ug/Kg | 99 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 100 | 102 | ug/Kg | 102 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 100 | 98.9 | ug/Kg | 99 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 100 | 104 | ug/Kg | 104 | 50 - 150 |

# Sample Results

## SB-VRTB-03_26-26.5

| | | | |
|---|---|---|---|
| **Collect Date** | 09/15/2021 09:04 | **Lab ID** | 22110171306 |
| **Receive Date** | 10/14/2021 11:00 | **Matrix** | Solid |

## PFAS Top Assay QSM B15 (Post)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 11/01/21 19:52 | 725404 | PFAS Top Assay QSM B15 (Post) | 1 | 11/02/21 19:47 | 725464 | ADA | 13.16 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.230U | 0.057 | 0.230 | 1.15 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.230U | 0.069 | 0.230 | 1.15 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.115U | 0.034 | 0.115 | 1.15 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.115U | 0.034 | 0.115 | 1.15 | ug/Kg |
| 919005-14-4 | ADONA | 0.057U | 0.011 | 0.057 | 1.15 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.115U | 0.034 | 0.115 | 1.15 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.575U | 0.161 | 0.575 | 2.30 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.115U | 0.046 | 0.115 | 1.15 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.115U | 0.034 | 0.115 | 1.15 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.115U | 0.046 | 0.115 | 1.15 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| 355-46-4 | Perfluorohexanesulfonic acid (PFHxS) | 0.115U | 0.034 | 0.115 | 1.15 | ug/Kg |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.115U | 0.034 | 0.115 | 1.15 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| **1763-23-1** | **Perfluorooctanesulfonic acid (PFOS)** | **0.062J** | **0.057** | **0.230** | **1.15** | **ug/Kg** |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.230U | 0.092 | 0.230 | 1.15 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.115U | 0.034 | 0.115 | 1.15 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.057U | 0.023 | 0.057 | 1.15 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 4.99 | 5.19 | ug/Kg | 104 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 99.80 | 103 | ug/Kg | 104 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 99.80 | 110 | ug/Kg | 110 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 99.80 | 117 | ug/Kg | 117 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 99.80 | 94 | ug/Kg | 94 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 99.80 | 101 | ug/Kg | 101 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 99.80 | 110 | ug/Kg | 110 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 99.80 | 117 | ug/Kg | 117 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 99.80 | 112 | ug/Kg | 113 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 99.80 | 114 | ug/Kg | 114 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 99.80 | 114 | ug/Kg | 114 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 99.80 | 112 | ug/Kg | 112 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 99.80 | 109 | ug/Kg | 109 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 99.80 | 117 | ug/Kg | 117 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 99.80 | 114 | ug/Kg | 115 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 99.80 | 105 | ug/Kg | 105 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 99.80 | 113 | ug/Kg | 114 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 99.80 | 112 | ug/Kg | 112 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 99.80 | 116 | ug/Kg | 116 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 99.80 | 40.4 | ug/Kg | **40*** | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 99.80 | 110 | ug/Kg | 111 | 50 - 150 |

# Sample Results

## SB-VRTB-03_30-30.5

| | | | |
|---|---|---|---|
| **Collect Date** | 09/15/2021 10:45 | **Lab ID** | 22110171307 |
| **Receive Date** | 10/14/2021 11:00 | **Matrix** | Solid |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/19/21 15:48 | 724063 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/22/21 04:42 | 724445 | RXJ | 9.45 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.221U | 0.055 | 0.221 | 1.10 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.221U | 0.066 | 0.221 | 1.10 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 919005-14-4 | ADONA | 0.055U | 0.011 | 0.055 | 1.10 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.552U | 0.155 | 0.552 | 2.21 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.110U | 0.044 | 0.110 | 1.10 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.110U | 0.044 | 0.110 | 1.10 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 355-46-4 | Perfluorohexanesulfonic acid (PFHxS) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| **1763-23-1** | **Perfluorooctanesulfonic acid (PFOS)** | **0.387J** | **0.055** | **0.221** | **1.10** | **ug/Kg** |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.221U | 0.088 | 0.221 | 1.10 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 5 | 5.92 | ug/Kg | 118 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 100 | 96.6 | ug/Kg | 97 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 100 | 104 | ug/Kg | 104 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 100 | 108 | ug/Kg | 108 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 100 | 107 | ug/Kg | 107 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 100 | 95.4 | ug/Kg | 95 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 100 | 103 | ug/Kg | 103 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 100 | 121 | ug/Kg | 121 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 100 | 105 | ug/Kg | 105 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 100 | 104 | ug/Kg | 104 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 100 | 107 | ug/Kg | 107 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 100 | 109 | ug/Kg | 109 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 100 | 107 | ug/Kg | 107 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 100 | 107 | ug/Kg | 107 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 100 | 107 | ug/Kg | 107 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 100 | 97.4 | ug/Kg | 97 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 100 | 109 | ug/Kg | 109 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 100 | 105 | ug/Kg | 105 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 100 | 109 | ug/Kg | 109 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 100 | 103 | ug/Kg | 103 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 100 | 116 | ug/Kg | 116 | 50 - 150 |

# Sample Results

## SB-VRTB-03_30-30.5

| | | | |
|---|---|---|---|
| **Collect Date** | 09/15/2021 10:45 | **Lab ID** | 22110171307 |
| **Receive Date** | 10/14/2021 11:00 | **Matrix** | Solid |

## PFAS Top Assay QSM B15 (Post)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/20/21 19:50 | 724306 | PFAS Top Assay QSM B15 (Post) | 1 | 10/25/21 19:48 | 724594 | ADA | 9.45 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.221U | 0.055 | 0.221 | 1.10 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.221U | 0.066 | 0.221 | 1.10 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 919005-14-4 | ADONA | 0.055U | 0.011 | 0.055 | 1.10 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.552U | 0.155 | 0.552 | 2.21 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.110U | 0.044 | 0.110 | 1.10 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.110U | 0.044 | 0.110 | 1.10 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| **355-46-4** | **Perfluorohexanesulfonic acid (PFHxS)** | **0.043J** | **0.033** | **0.110** | **1.10** | **ug/Kg** |
| **307-24-4** | **Perfluorohexanoic acid (PFHxA)** | **0.035J** | **0.022** | **0.055** | **1.10** | **ug/Kg** |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| **1763-23-1** | **Perfluorooctanesulfonic acid (PFOS)** | **0.641J** | **0.055** | **0.221** | **1.10** | **ug/Kg** |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.221U | 0.088 | 0.221 | 1.10 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| **2706-90-3** | **Perfluoropentanoic acid (PFPeA)** | **0.027J** | **0.022** | **0.055** | **1.10** | **ug/Kg** |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.110U | 0.033 | 0.110 | 1.10 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.055U | 0.022 | 0.055 | 1.10 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 5 | 3.62 | ug/Kg | 72 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 100 | 58.4 | ug/Kg | 58 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 100 | 67 | ug/Kg | 67 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 100 | 76.3 | ug/Kg | 76 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 100 | 71.7 | ug/Kg | 72 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 100 | 77 | ug/Kg | 77 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 100 | 65.4 | ug/Kg | 65 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 100 | 66.1 | ug/Kg | 66 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 100 | 78.4 | ug/Kg | 78 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 100 | 77 | ug/Kg | 77 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 100 | 65.3 | ug/Kg | 65 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 100 | 65.9 | ug/Kg | 66 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 100 | 63.6 | ug/Kg | 64 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 100 | 71.7 | ug/Kg | 72 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 100 | 68.2 | ug/Kg | 68 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 100 | 62.4 | ug/Kg | 62 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 100 | 67 | ug/Kg | 67 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 100 | 78.1 | ug/Kg | 78 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 100 | 68.3 | ug/Kg | 68 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 100 | 62.4 | ug/Kg | 62 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 100 | 68.5 | ug/Kg | 68 | 50 - 150 |

# Sample Results

| **SB-VRTB-03_36-36.5** | **Collect Date** | 09/15/2021 11:42 | **Lab ID** | 22110171308 |
|---|---|---|---|---|
| | **Receive Date** | 10/14/2021 11:00 | **Matrix** | Solid |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/19/21 15:48 | 724063 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/22/21 04:57 | 724445 | RXJ | 13.16 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.225U | 0.056 | 0.225 | 1.12 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.225U | 0.067 | 0.225 | 1.12 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.112U | 0.034 | 0.112 | 1.12 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.112U | 0.034 | 0.112 | 1.12 | ug/Kg |
| 919005-14-4 | ADONA | 0.056U | 0.011 | 0.056 | 1.12 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.112U | 0.034 | 0.112 | 1.12 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.562U | 0.157 | 0.562 | 2.25 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.112U | 0.045 | 0.112 | 1.12 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.112U | 0.034 | 0.112 | 1.12 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.112U | 0.045 | 0.112 | 1.12 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 355-46-4 | Perfluorohexanesulfonic acid (PFHxS) | 0.112U | 0.034 | 0.112 | 1.12 | ug/Kg |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.112U | 0.034 | 0.112 | 1.12 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 1763-23-1 | Perfluorooctanesulfonic acid (PFOS) | 0.225U | 0.056 | 0.225 | 1.12 | ug/Kg |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.225U | 0.090 | 0.225 | 1.12 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.112U | 0.034 | 0.112 | 1.12 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.056U | 0.022 | 0.056 | 1.12 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 4.88 | 5.79 | ug/Kg | 119 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 97.70 | 90.5 | ug/Kg | 93 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 97.70 | 103 | ug/Kg | 106 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 97.70 | 126 | ug/Kg | 129 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 97.70 | 120 | ug/Kg | 123 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 97.70 | 103 | ug/Kg | 105 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 97.70 | 89.4 | ug/Kg | 92 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 97.70 | 111 | ug/Kg | 114 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 97.70 | 96.4 | ug/Kg | 99 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 97.70 | 95.1 | ug/Kg | 97 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 97.70 | 98.9 | ug/Kg | 101 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 97.70 | 101 | ug/Kg | 104 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 97.70 | 98.1 | ug/Kg | 100 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 97.70 | 102 | ug/Kg | 105 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 97.70 | 106 | ug/Kg | 109 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 97.70 | 87.7 | ug/Kg | 90 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 97.70 | 104 | ug/Kg | 106 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 97.70 | 95.9 | ug/Kg | 98 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 97.70 | 101 | ug/Kg | 104 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 97.70 | 93.6 | ug/Kg | 96 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 97.70 | 121 | ug/Kg | 124 | 50 - 150 |

# Sample Results

## SB-VRTB-03_36-36.5

| | | | |
|---|---|---|---|
| **Collect Date** | 09/15/2021 11:42 | **Lab ID** | 22110171308 |
| **Receive Date** | 10/14/2021 11:00 | **Matrix** | Solid |

## PFAS Top Assay QSM B15 (Post)

*Results and limits adjusted for moisture content

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 11/01/21 19:52 | 725404 | PFAS Top Assay QSM B15 (Post) | 1 | 11/02/21 20:02 | 725464 | ADA | 13.16 |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.227U | 0.057 | 0.227 | 1.13 | ug/Kg |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.227U | 0.068 | 0.227 | 1.13 | ug/Kg |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.113U | 0.034 | 0.113 | 1.13 | ug/Kg |
| 756426-58-1 | 9Cl-PF3ONS | 0.113U | 0.034 | 0.113 | 1.13 | ug/Kg |
| 919005-14-4 | ADONA | 0.057U | 0.011 | 0.057 | 1.13 | ug/Kg |
| 2991-50-6 | NEtFOSAA | 0.113U | 0.034 | 0.113 | 1.13 | ug/Kg |
| 2355-31-9 | NMeFOSAA | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.567U | 0.159 | 0.567 | 2.27 | ug/Kg |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 0.113U | 0.045 | 0.113 | 1.13 | ug/Kg |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 0.113U | 0.034 | 0.113 | 1.13 | ug/Kg |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 0.113U | 0.045 | 0.113 | 1.13 | ug/Kg |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 355-46-4 | Perfluorohexanesulfonic acid (PFHxS) | 0.113U | 0.034 | 0.113 | 1.13 | ug/Kg |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 0.113U | 0.034 | 0.113 | 1.13 | ug/Kg |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 1763-23-1 | Perfluorooctanesulfonic acid (PFOS) | 0.227U | 0.057 | 0.227 | 1.13 | ug/Kg |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 0.227U | 0.091 | 0.227 | 1.13 | ug/Kg |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 0.113U | 0.034 | 0.113 | 1.13 | ug/Kg |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 0.057U | 0.023 | 0.057 | 1.13 | ug/Kg |

| CAS# | Extracted ISTD | Conc. Spiked | Conc. Rec | Units | % Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 4.92 | 4.95 | ug/Kg | 100 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 98.40 | 99.5 | ug/Kg | 101 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 98.40 | 103 | ug/Kg | 105 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 98.40 | 109 | ug/Kg | 111 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 98.40 | 88.8 | ug/Kg | 90 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 98.40 | 91.1 | ug/Kg | 93 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 98.40 | 103 | ug/Kg | 105 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 98.40 | 112 | ug/Kg | 114 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 98.40 | 115 | ug/Kg | 117 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 98.40 | 115 | ug/Kg | 117 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 98.40 | 111 | ug/Kg | 113 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 98.40 | 107 | ug/Kg | 109 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 98.40 | 108 | ug/Kg | 110 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 98.40 | 111 | ug/Kg | 113 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 98.40 | 111 | ug/Kg | 113 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 98.40 | 98.3 | ug/Kg | 100 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 98.40 | 113 | ug/Kg | 115 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 98.40 | 113 | ug/Kg | 115 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 98.40 | 109 | ug/Kg | 111 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 98.40 | 104 | ug/Kg | 106 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 98.40 | 104 | ug/Kg | 106 | 50 - 150 |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB724306 | LCS724306 | LCSD724306 |
|---|---|---|---|---|
| 724594 | Lab ID | 2257991 | 2257992 | 2257993 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 724306 | Prep Date | 10/20/21 19:50 | 10/20/21 19:50 | 10/20/21 19:50 |
| **Prep Method** | Analysis Date | 10/25/21 17:37 | 10/25/21 17:51 | 10/25/21 18:06 |
| PFAS Top Assay QSM B15 (Post) | Matrix | Solid | Solid | Solid |

| **PFAS Top Assay QSM B15 (Post)** | | Units Result | ug/Kg LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 763051-92-9 | 0.050U | 0.050 | 1.89 | 1.96 | 104 | 70 - 130 | 1.89 | 1.90 | 101 | 4 | 30 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 0.200U | 0.200 | 1.87 | 2.00 | 107 | 70 - 130 | 1.87 | 2.00 | 107 | 0 | 30 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 0.200U | 0.200 | 1.90 | 2.10 | 110 | 70 - 130 | 1.90 | 2.00 | 105 | 5 | 30 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 0.100U | 0.100 | 1.92 | 2.20 | 115 | 70 - 130 | 1.92 | 2.01 | 105 | 9 | 30 |
| 9Cl-PF3ONS | 756426-58-1 | 0.100U | 0.100 | 1.87 | 1.98 | 106 | 70 - 130 | 1.87 | 1.93 | 104 | 2 | 30 |
| ADONA | 919005-14-4 | 0.050U | 0.050 | 1.89 | 2.03 | 108 | 70 - 130 | 1.89 | 1.94 | 103 | 4 | 30 |
| NEtFOSAA | 2991-50-6 | 0.100U | 0.100 | 2.00 | 2.15 | 107 | 70 - 130 | 2.00 | 2.09 | 105 | 3 | 30 |
| NMeFOSAA | 2355-31-9 | 0.050U | 0.050 | 2.00 | 2.14 | 107 | 70 - 130 | 2.00 | 2.25 | 113 | 5 | 30 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 0.500U | 0.500 | 4.00 | 4.26 | 106 | 70 - 130 | 4.00 | 4.21 | 105 | 1 | 30 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 0.050U | 0.050 | 1.77 | 1.91 | 108 | 70 - 130 | 1.77 | 1.87 | 105 | 2 | 30 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 0.100U | 0.100 | 2.00 | 2.17 | 108 | 70 - 130 | 2.00 | 2.11 | 106 | 3 | 30 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 0.100U | 0.100 | 1.93 | 2.16 | 112 | 70 - 130 | 1.93 | 2.07 | 107 | 4 | 30 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 0.100U | 0.100 | 2.00 | 2.15 | 107 | 70 - 130 | 2.00 | 2.09 | 105 | 3 | 30 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 0.050U | 0.050 | 2.00 | 2.21 | 111 | 70 - 130 | 2.00 | 2.18 | 109 | 1 | 30 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 0.050U | 0.050 | 1.91 | 2.05 | 108 | 70 - 130 | 1.91 | 1.99 | 105 | 3 | 30 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 0.050U | 0.050 | 2.00 | 2.14 | 107 | 70 - 130 | 2.00 | 2.11 | 105 | 1 | 30 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 0.100U | 0.100 | 1.83 | 1.95 | 107 | 70 - 130 | 1.83 | 1.85 | 101 | 5 | 30 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 0.050U | 0.050 | 2.00 | 2.13 | 107 | 70 - 130 | 2.00 | 2.08 | 104 | 3 | 30 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 0.100U | 0.100 | 1.92 | 2.13 | 110 | 70 - 130 | 1.92 | 2.05 | 107 | 4 | 30 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 0.050U | 0.050 | 2.00 | 2.18 | 109 | 70 - 130 | 2.00 | 2.11 | 105 | 4 | 30 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 0.050U | 0.050 | 2.00 | 2.15 | 108 | 70 - 130 | 2.00 | 2.15 | 107 | 0 | 30 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 0.200U | 0.200 | 1.86 | 1.91 | 103 | 70 - 130 | 1.86 | 1.87 | 101 | 2 | 30 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 0.200U | 0.200 | 2.00 | 2.16 | 108 | 70 - 130 | 2.00 | 2.07 | 103 | 4 | 30 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 0.050U | 0.050 | 1.88 | 2.03 | 108 | 70 - 130 | 1.88 | 1.99 | 106 | 2 | 30 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 0.050U | 0.050 | 2.00 | 2.13 | 107 | 70 - 130 | 2.00 | 2.07 | 103 | 3 | 30 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 0.050U | 0.050 | 2.00 | 2.15 | 108 | 70 - 130 | 2.00 | 2.13 | 107 | 1 | 30 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 0.100U | 0.100 | 2.00 | 2.19 | 109 | 70 - 130 | 2.00 | 2.18 | 109 | 0 | 30 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 0.050U | 0.050 | 2.00 | 2.20 | 110 | 70 - 130 | 2.00 | 2.18 | 109 | 1 | 30 |
| | | | | | | | | | | | | |
| d3-NMeFOSAA | 2355-31-9-EIS | 76.4 | 76 | 100 | 83.7 | 84 | 50 - 150 | 100 | 74.2 | 74 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 81.8 | 82 | 100 | 85.4 | 85 | 50 - 150 | 100 | 80.7 | 81 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 82 | 82 | 100 | 86.5 | 87 | 50 - 150 | 100 | 80.9 | 81 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 82.5 | 82 | 100 | 84.9 | 85 | 50 - 150 | 100 | 85 | 85 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 87.1 | 87 | 100 | 88.5 | 88 | 50 - 150 | 100 | 90.2 | 90 | NA | NA |
| M2PFTA | 376-06-7-EIS | 78.1 | 78 | 100 | 82.5 | 83 | 50 - 150 | 100 | 77.3 | 77 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 72.2 | 72 | 100 | 89.8 | 90 | 50 - 150 | 100 | 85.3 | 85 | NA | NA |
| M3PFBS | 375-73-5-EIS | 83.2 | 83 | 100 | 86.5 | 87 | 50 - 150 | 100 | 82.2 | 82 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 83.4 | 83 | 100 | 88.2 | 88 | 50 - 150 | 100 | 84 | 84 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 76 | 76 | 100 | 86.3 | 86 | 50 - 150 | 100 | 82.6 | 83 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 73.9 | 74 | 100 | 87.3 | 87 | 50 - 150 | 100 | 84.7 | 85 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 70.9 | 71 | 100 | 86.6 | 87 | 50 - 150 | 100 | 83.6 | 84 | NA | NA |
| M6PFDA | 335-76-2-EIS | 84 | 84 | 100 | 88.6 | 89 | 50 - 150 | 100 | 84.8 | 85 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 82.8 | 83 | 100 | 85.4 | 85 | 50 - 150 | 100 | 80.4 | 80 | NA | NA |
| M8FOSA | 754-91-6-EIS | 70.9 | 71 | 100 | 89.7 | 90 | 50 - 150 | 100 | 84 | 84 | NA | NA |
| M8PFOA | 335-67-1-EIS | 79.6 | 80 | 100 | 87.5 | 87 | 50 - 150 | 100 | 85.1 | 85 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 86.9 | 87 | 100 | 89.9 | 90 | 50 - 150 | 100 | 86.7 | 87 | NA | NA |
| M9PFNA | 375-95-1-EIS | 80.8 | 81 | 100 | 87.4 | 87 | 50 - 150 | 100 | 84.4 | 84 | NA | NA |
| MPFBA | 375-22-4-EIS | 68.3 | 68 | 100 | 85.1 | 85 | 50 - 150 | 100 | 82 | 82 | NA | NA |
| MPFDoA | 307-55-1-EIS | 78.6 | 79 | 100 | 83.5 | 84 | 50 - 150 | 100 | 78 | 78 | NA | NA |
| MPFOA | 335-67-1-SUR | 4.16 | 83 | 5 | 4.54 | 91 | 50 - 150 | 5 | 4.42 | 88 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB725404 | LCS725404 | LCSD725404 |
|---|---|---|---|---|
| 725464 | Lab ID | 2264800 | 2264801 | 2264802 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 725404 | Prep Date | 11/01/21 19:52 | 11/01/21 19:52 | 11/01/21 19:52 |
| **Prep Method** | Analysis Date | 11/02/21 19:03 | 11/02/21 19:18 | 11/02/21 19:33 |
| PFAS Top Assay QSM B15 (Post) | Matrix | Solid | Solid | Solid |

| **PFAS Top Assay QSM B15 (Post)** | | Units Result | ug/Kg LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 763051-92-9 | 0.050U | 0.050 | 1.89 | 1.83 | 97 | 70 - 130 | 1.89 | 1.82 | 96 | 1 | 30 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 0.200U | 0.200 | 1.87 | 1.83 | 97 | 70 - 130 | 1.87 | 1.97 | 105 | 8 | 30 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 0.200U | 0.200 | 1.90 | 1.97 | 103 | 70 - 130 | 1.90 | 1.95 | 102 | 1 | 30 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 0.100U | 0.100 | 1.92 | 2.00 | 104 | 70 - 130 | 1.92 | 1.95 | 102 | 3 | 30 |
| 9Cl-PF3ONS | 756426-58-1 | 0.100U | 0.100 | 1.87 | 1.84 | 99 | 70 - 130 | 1.87 | 1.86 | 100 | 1 | 30 |
| ADONA | 919005-14-4 | 0.050U | 0.050 | 1.89 | 1.79 | 95 | 70 - 130 | 1.89 | 1.80 | 95 | 1 | 30 |
| NEtFOSAA | 2991-50-6 | 0.100U | 0.100 | 2.00 | 1.97 | 98 | 70 - 130 | 2.00 | 2.01 | 101 | 2 | 30 |
| NMeFOSAA | 2355-31-9 | 0.050U | 0.050 | 2.00 | 1.88 | 94 | 70 - 130 | 2.00 | 1.93 | 96 | 2 | 30 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 0.500U | 0.500 | 4.00 | 3.84 | 96 | 70 - 130 | 4.00 | 3.89 | 97 | 1 | 30 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 0.050U | 0.050 | 1.77 | 1.73 | 98 | 70 - 130 | 1.77 | 1.78 | 100 | 2 | 30 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 0.100U | 0.100 | 2.00 | 1.95 | 97 | 70 - 130 | 2.00 | 1.98 | 99 | 1 | 30 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 0.100U | 0.100 | 1.93 | 1.88 | 97 | 70 - 130 | 1.93 | 1.91 | 99 | 2 | 30 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 0.100U | 0.100 | 2.00 | 1.90 | 95 | 70 - 130 | 2.00 | 1.93 | 97 | 2 | 30 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 0.050U | 0.050 | 2.00 | 1.88 | 94 | 70 - 130 | 2.00 | 1.88 | 94 | 0 | 30 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 0.050U | 0.050 | 1.91 | 1.88 | 99 | 70 - 130 | 1.91 | 1.93 | 101 | 2 | 30 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 0.050U | 0.050 | 2.00 | 1.96 | 98 | 70 - 130 | 2.00 | 1.95 | 97 | 1 | 30 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 0.100U | 0.100 | 1.83 | 1.79 | 98 | 70 - 130 | 1.83 | 1.80 | 99 | 1 | 30 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 0.050U | 0.050 | 2.00 | 1.95 | 98 | 70 - 130 | 2.00 | 1.95 | 98 | 0 | 30 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 0.100U | 0.100 | 1.92 | 1.88 | 98 | 70 - 130 | 1.92 | 1.91 | 99 | 2 | 30 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 0.050U | 0.050 | 2.00 | 1.94 | 97 | 70 - 130 | 2.00 | 1.95 | 98 | 0 | 30 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 0.050U | 0.050 | 2.00 | 1.97 | 98 | 70 - 130 | 2.00 | 1.99 | 99 | 1 | 30 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 0.200U | 0.200 | 1.86 | 1.76 | 95 | 70 - 130 | 1.86 | 1.81 | 98 | 3 | 30 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 0.200U | 0.200 | 2.00 | 1.93 | 96 | 70 - 130 | 2.00 | 1.95 | 98 | 1 | 30 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 0.050U | 0.050 | 1.88 | 1.82 | 97 | 70 - 130 | 1.88 | 1.84 | 98 | 1 | 30 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 0.050U | 0.050 | 2.00 | 1.94 | 97 | 70 - 130 | 2.00 | 1.95 | 97 | 0 | 30 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 0.050U | 0.050 | 2.00 | 1.92 | 96 | 70 - 130 | 2.00 | 1.89 | 94 | 2 | 30 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 0.100U | 0.100 | 2.00 | 1.86 | 93 | 70 - 130 | 2.00 | 1.91 | 95 | 2 | 30 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 0.050U | 0.050 | 2.00 | 1.93 | 96 | 70 - 130 | 2.00 | 1.96 | 98 | 2 | 30 |
| | | | | | | | | | | | | |
| d3-NMeFOSAA | 2355-31-9-EIS | 107 | 107 | 100 | 109 | 109 | 50 - 150 | 100 | 104 | 104 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 116 | 116 | 100 | 111 | 111 | 50 - 150 | 100 | 107 | 107 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 115 | 115 | 100 | 116 | 116 | 50 - 150 | 100 | 110 | 110 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 104 | 104 | 100 | 101 | 101 | 50 - 150 | 100 | 97.1 | 97 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 93.8 | 94 | 100 | 96.7 | 97 | 50 - 150 | 100 | 99.1 | 99 | NA | NA |
| M2PFTA | 376-06-7-EIS | 114 | 114 | 100 | 112 | 112 | 50 - 150 | 100 | 114 | 114 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 123 | 123 | 100 | 119 | 119 | 50 - 150 | 100 | 110 | 110 | NA | NA |
| M3PFBS | 375-73-5-EIS | 119 | 119 | 100 | 116 | 116 | 50 - 150 | 100 | 115 | 115 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 117 | 117 | 100 | 114 | 114 | 50 - 150 | 100 | 113 | 113 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 119 | 119 | 100 | 117 | 117 | 50 - 150 | 100 | 109 | 109 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 117 | 117 | 100 | 115 | 115 | 50 - 150 | 100 | 107 | 107 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 118 | 118 | 100 | 117 | 117 | 50 - 150 | 100 | 107 | 107 | NA | NA |
| M6PFDA | 335-76-2-EIS | 118 | 118 | 100 | 117 | 117 | 50 - 150 | 100 | 111 | 111 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 119 | 119 | 100 | 115 | 115 | 50 - 150 | 100 | 111 | 111 | NA | NA |
| M8FOSA | 754-91-6-EIS | 108 | 108 | 100 | 106 | 106 | 50 - 150 | 100 | 95.9 | 96 | NA | NA |
| M8PFOA | 335-67-1-EIS | 119 | 119 | 100 | 118 | 118 | 50 - 150 | 100 | 109 | 109 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 117 | 117 | 100 | 113 | 113 | 50 - 150 | 100 | 112 | 112 | NA | NA |
| M9PFNA | 375-95-1-EIS | 118 | 118 | 100 | 116 | 116 | 50 - 150 | 100 | 109 | 109 | NA | NA |
| MPFBA | 375-22-4-EIS | 115 | 115 | 100 | 115 | 115 | 50 - 150 | 100 | 105 | 105 | NA | NA |
| MPFDoA | 307-55-1-EIS | 113 | 113 | 100 | 114 | 114 | 50 - 150 | 100 | 112 | 112 | NA | NA |
| MPFOA | 335-67-1-SUR | 6.2 | 124 | 5 | 6.08 | 122 | 50 - 150 | 5 | 5.6 | 112 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB724063 | LCS724063 | LCSD724063 |
|---|---|---|---|---|
| 724445 | Lab ID | 2256614 | 2256615 | 2256616 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 724063 | Prep Date | 10/19/21 15:48 | 10/19/21 15:48 | 10/19/21 15:48 |
| **Prep Method** | Analysis Date | 10/22/21 02:28 | 10/22/21 02:44 | 10/22/21 02:58 |
| PFAS Top Assay QSM B15 (Pre) | Matrix | Solid | Solid | Solid |

| **PFAS Top Assay QSM B15 (Pre)** | | Units Result | ug/Kg LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 763051-92-9 | 0.050U | 0.050 | 1.89 | 2.04 | 108 | 70 - 130 | 1.89 | 2.02 | 107 | 1 | 30 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 0.200U | 0.200 | 1.87 | 2.13 | 114 | 70 - 130 | 1.87 | 2.11 | 113 | 1 | 30 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 0.200U | 0.200 | 1.90 | 2.23 | 117 | 70 - 130 | 1.90 | 2.13 | 112 | 4 | 30 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 0.100U | 0.100 | 1.92 | 2.32 | 121 | 70 - 130 | 1.92 | 2.23 | 116 | 4 | 30 |
| 9Cl-PF3ONS | 756426-58-1 | 0.100U | 0.100 | 1.87 | 2.02 | 108 | 70 - 130 | 1.87 | 2.05 | 110 | 1 | 30 |
| ADONA | 919005-14-4 | 0.050U | 0.050 | 1.89 | 1.98 | 105 | 70 - 130 | 1.89 | 2.00 | 106 | 1 | 30 |
| NEtFOSAA | 2991-50-6 | 0.100U | 0.100 | 2.00 | 2.21 | 111 | 70 - 130 | 2.00 | 2.14 | 107 | 3 | 30 |
| NMeFOSAA | 2355-31-9 | 0.050U | 0.050 | 2.00 | 2.25 | 112 | 70 - 130 | 2.00 | 2.28 | 114 | 1 | 30 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 0.500U | 0.500 | 4.00 | 4.56 | 114 | 70 - 130 | 4.00 | 4.51 | 113 | 1 | 30 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 0.050U | 0.050 | 1.77 | 1.98 | 111 | 70 - 130 | 1.77 | 1.94 | 110 | 2 | 30 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 0.100U | 0.100 | 2.00 | 2.19 | 109 | 70 - 130 | 2.00 | 2.22 | 111 | 1 | 30 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 0.100U | 0.100 | 1.93 | 2.11 | 109 | 70 - 130 | 1.93 | 2.08 | 108 | 2 | 30 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 0.100U | 0.100 | 2.00 | 2.22 | 111 | 70 - 130 | 2.00 | 2.19 | 110 | 1 | 30 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 0.050U | 0.050 | 2.00 | 2.17 | 108 | 70 - 130 | 2.00 | 2.24 | 112 | 3 | 30 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 0.050U | 0.050 | 1.91 | 2.04 | 107 | 70 - 130 | 1.91 | 2.09 | 110 | 2 | 30 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 0.050U | 0.050 | 2.00 | 2.16 | 108 | 70 - 130 | 2.00 | 2.15 | 108 | 0 | 30 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 0.100U | 0.100 | 1.83 | 1.96 | 107 | 70 - 130 | 1.83 | 1.96 | 107 | 0 | 30 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 0.050U | 0.050 | 2.00 | 2.16 | 108 | 70 - 130 | 2.00 | 2.17 | 108 | 0 | 30 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 0.100U | 0.100 | 1.92 | 2.07 | 108 | 70 - 130 | 1.92 | 2.09 | 109 | 1 | 30 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 0.050U | 0.050 | 2.00 | 2.18 | 109 | 70 - 130 | 2.00 | 2.16 | 108 | 1 | 30 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 0.050U | 0.050 | 2.00 | 2.25 | 113 | 70 - 130 | 2.00 | 2.20 | 110 | 2 | 30 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 0.200U | 0.200 | 1.86 | 2.00 | 108 | 70 - 130 | 1.86 | 2.00 | 108 | 0 | 30 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 0.200U | 0.200 | 2.00 | 2.15 | 108 | 70 - 130 | 2.00 | 2.15 | 107 | 0 | 30 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 0.050U | 0.050 | 1.88 | 2.05 | 109 | 70 - 130 | 1.88 | 2.06 | 109 | 0 | 30 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 0.050U | 0.050 | 2.00 | 2.16 | 108 | 70 - 130 | 2.00 | 2.16 | 108 | 0 | 30 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 0.050U | 0.050 | 2.00 | 2.16 | 108 | 70 - 130 | 2.00 | 2.21 | 111 | 3 | 30 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 0.100U | 0.100 | 2.00 | 2.16 | 108 | 70 - 130 | 2.00 | 2.22 | 111 | 3 | 30 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 0.050U | 0.050 | 2.00 | 2.16 | 108 | 70 - 130 | 2.00 | 2.20 | 110 | 2 | 30 |
| | | | | | | | | | | | | |
| d3-NMeFOSAA | 2355-31-9-EIS | 92.4 | 92 | 100 | 95.1 | 95 | 50 - 150 | 100 | 87.5 | 88 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 100 | 100 | 100 | 97.9 | 98 | 50 - 150 | 100 | 92.9 | 93 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 98.7 | 99 | 100 | 97.6 | 98 | 50 - 150 | 100 | 91.7 | 92 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 94.4 | 94 | 100 | 97 | 97 | 50 - 150 | 100 | 94.6 | 95 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 90.5 | 91 | 100 | 90.2 | 90 | 50 - 150 | 100 | 84.1 | 84 | NA | NA |
| M2PFTA | 376-06-7-EIS | 98.1 | 98 | 100 | 98.3 | 98 | 50 - 150 | 100 | 92 | 92 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 117 | 117 | 100 | 110 | 110 | 50 - 150 | 100 | 105 | 105 | NA | NA |
| M3PFBS | 375-73-5-EIS | 102 | 102 | 100 | 100 | 100 | 50 - 150 | 100 | 95.7 | 96 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 102 | 102 | 100 | 103 | 103 | 50 - 150 | 100 | 97.2 | 97 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 103 | 103 | 100 | 101 | 101 | 50 - 150 | 100 | 95.3 | 95 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 105 | 105 | 100 | 101 | 101 | 50 - 150 | 100 | 95.8 | 96 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 103 | 103 | 100 | 100 | 100 | 50 - 150 | 100 | 94.8 | 95 | NA | NA |
| M6PFDA | 335-76-2-EIS | 104 | 104 | 100 | 101 | 101 | 50 - 150 | 100 | 96.6 | 97 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 103 | 103 | 100 | 104 | 104 | 50 - 150 | 100 | 95.3 | 95 | NA | NA |
| M8FOSA | 754-91-6-EIS | 90.8 | 91 | 100 | 86.5 | 86 | 50 - 150 | 100 | 86 | 86 | NA | NA |
| M8PFOA | 335-67-1-EIS | 104 | 104 | 100 | 103 | 103 | 50 - 150 | 100 | 97.5 | 98 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 103 | 103 | 100 | 102 | 102 | 50 - 150 | 100 | 96.9 | 97 | NA | NA |
| M9PFNA | 375-95-1-EIS | 104 | 104 | 100 | 104 | 104 | 50 - 150 | 100 | 98.5 | 98 | NA | NA |
| MPFBA | 375-22-4-EIS | 101 | 101 | 100 | 98.2 | 98 | 50 - 150 | 100 | 93.4 | 93 | NA | NA |
| MPFDoA | 307-55-1-EIS | 98.9 | 99 | 100 | 100 | 100 | 50 - 150 | 100 | 91.6 | 92 | NA | NA |
| MPFOA | 335-67-1-SUR | 5.6 | 112 | 5 | 5.35 | 107 | 50 - 150 | 5 | 5.15 | 103 | NA | NA |

# Top Assay Pre/Post Summary

| **Client ID** | SB-VRTB-03_13.75-14 | | | | SB-VRTB-03_14.75-15 | | | |
|---|---|---|---|---|---|---|---|---|
| **LAB ID** | 22110171301 | | | | 22110171302 | | | |
| **Collected** | 09/14/21 12:40 | | | | 09/14/21 12:50 | | | |
| **Matrix** | Solid | | | | Solid | | | |
| **Units** | ug/Kg | | | | ug/Kg | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.051U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.204U | 0.205U | 0 | 0 | 0.195U | 0.203U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.204U | 0.205U | 0 | 0 | 0.195U | 0.203U | 0 | 0 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.102U | 0.102U | 0 | 0 | 0.097U | 0.102U | 0 | 0 |
| 9Cl-PF3ONS | 0.102U | 0.102U | 0 | 0 | 0.097U | 0.102U | 0 | 0 |
| ADONA | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.051U | 0 | 0 |
| NEtFOSAA | 0.102U | 0.102U | 0 | 0 | 0.097U | 0.102U | 0 | 0 |
| NMeFOSAA | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.051U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.511U | 0.512U | 0 | 0 | 0.487U | 0.508U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.051U | 0 | 0 |
| Perfluorobutanoic acid (PFBA) | 0.102U | 0.102U | 0 | 0 | 0.097U | 0.296J | 0.296 | 200 |
| Perfluorodecane sulfonic acid (PFDS) | 0.102U | 0.102U | 0 | 0 | 0.097U | 0.102U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 0.102U | 0.102U | 0 | 0 | 0.097U | 0.102U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.051U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.051U | 0 | 0 |
| Perfluoroheptanoic acid (PFHpA) | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.090J | 0.09 | 200 |
| Perfluorohexanesulfonic acid (PFHxS) | 0.102U | 0.102U | 0 | 0 | 0.097U | 0.035J | 0.035 | 200 |
| Perfluorohexanoic acid (PFHxA) | 0.051U | 0.021J | 0.021 | 200 | 0.049U | 0.193J | 0.193 | 200 |
| Perfluorononanesulfonic acid (PFNS) | 0.102U | 0.102U | 0 | 0 | 0.097U | 0.102U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.051U | 0 | 0 |
| Perfluorooctane Sulfonamide (FOSA) | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.051U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 0.204U | 0.205U | 0 | 0 | 0.195U | 0.203U | 0 | 0 |
| Perfluorooctanoic acid (PFOA) | 0.204U | 0.205U | 0 | 0 | 0.195U | 0.203U | 0 | 0 |
| Perfluoropentanesulfonic acid (PFPeS) | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.051U | 0 | 0 |
| Perfluoropentanoic acid (PFPeA) | 0.051U | 0.030J | 0.03 | 200 | 0.049U | 0.644J | 0.644 | 200 |
| Perfluorotetradecanoic acid (PFTA) | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.051U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 0.102U | 0.102U | 0 | 0 | 0.097U | 0.102U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 0.051U | 0.051U | 0 | 0 | 0.049U | 0.051U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| **Client ID** | SB-VRTB-03_16.5-17 | | | | SB-VRTB-03_19-19.5 | | | |
|---|---|---|---|---|---|---|---|---|
| **LAB ID** | 22110171303 | | | | 22110171304 | | | |
| **Collected** | 09/14/21 14:30 | | | | 09/14/21 14:48 | | | |
| **Matrix** | Solid | | | | Solid | | | |
| **Units** | ug/Kg | | | | ug/Kg | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 0.055U | 0.055U | 0 | 0 | 0.053U | 0.052U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.218U | 0.218U | 0 | 0 | 0.213U | 0.208U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.218U | 0.218U | 0 | 0 | 0.213U | 0.208U | 0 | 0 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.109U | 0.109U | 0 | 0 | 0.107U | 0.104U | 0 | 0 |
| 9Cl-PF3ONS | 0.109U | 0.109U | 0 | 0 | 0.107U | 0.104U | 0 | 0 |
| ADONA | 0.055U | 0.055U | 0 | 0 | 0.053U | 0.052U | 0 | 0 |
| NEtFOSAA | 0.109U | 0.109U | 0 | 0 | 0.107U | 0.104U | 0 | 0 |
| NMeFOSAA | 0.055U | 0.055U | 0 | 0 | 0.053U | 0.052U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.545U | 0.546U | 0 | 0 | 0.533U | 0.521U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 0.055U | 0.055U | 0 | 0 | 0.053U | 0.052U | 0 | 0 |
| Perfluorobutanoic acid (PFBA) | 0.109U | 0.046J | 0.046 | 200 | 0.107U | 0.047J | 0.047 | 200 |
| Perfluorodecane sulfonic acid (PFDS) | 0.109U | 0.109U | 0 | 0 | 0.107U | 0.104U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 0.109U | 0.109U | 0 | 0 | 0.107U | 0.104U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 0.055U | 0.055U | 0 | 0 | 0.053U | 0.052U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 0.055U | 0.055U | 0 | 0 | 0.053U | 0.023J | -0.03 | 78.9 |
| Perfluoroheptanoic acid (PFHpA) | 0.055U | 0.024J | 0.024 | 200 | 0.053U | 0.037J | 0.037 | 200 |
| Perfluorohexanesulfonic acid (PFHxS) | 0.086J | 0.174J | 0.088 | 67.7 | 0.152J | 0.161J | 0.009 | 5.8 |
| Perfluorohexanoic acid (PFHxA) | 0.055U | 0.225J | 0.225 | 200 | 0.024J | 0.302J | 0.278 | 170.6 |
| Perfluorononanesulfonic acid (PFNS) | 0.109U | 0.109U | 0 | 0 | 0.107U | 0.104U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 0.055U | 0.055U | 0 | 0 | 0.053U | 0.052U | 0 | 0 |
| Perfluorooctane Sulfonamide (FOSA) | 0.055U | 0.055U | 0 | 0 | 0.053U | 0.052U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 1.35 | 2.37 | 1.02 | 54.8 | 5.62 | 5.07 | -0.55 | 10.3 |
| Perfluorooctanoic acid (PFOA) | 0.218U | 0.218U | 0 | 0 | 0.213U | 0.208U | 0 | 0 |
| Perfluoropentanesulfonic acid (PFPeS) | 0.055U | 0.055U | 0 | 0 | 0.053U | 0.052U | 0 | 0 |
| Perfluoropentanoic acid (PFPeA) | 0.055U | 0.084J | 0.084 | 200 | 0.053U | 0.104J | 0.104 | 200 |
| Perfluorotetradecanoic acid (PFTA) | 0.055U | 0.055U | 0 | 0 | 0.053U | 0.052U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 0.109U | 0.109U | 0 | 0 | 0.107U | 0.104U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 0.055U | 0.055U | 0 | 0 | 0.053U | 0.052U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| **Client ID** | SB-VRTB-03_22.5-23 | | | | SB-VRTB-03_26-26.5 | | | |
|---|---|---|---|---|---|---|---|---|
| **LAB ID** | 22110171305 | | | | 22110171306 | | | |
| **Collected** | 09/14/21 15:55 | | | | 09/15/21 09:04 | | | |
| **Matrix** | Solid | | | | Solid | | | |
| **Units** | ug/Kg | | | | ug/Kg | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 0.056U | 0.055U | 0 | 0 | 0.058U | 0.057U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.222U | 0.221U | 0 | 0 | 0.230U | 0.230U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.222U | 0.221U | 0 | 0 | 0.230U | 0.230U | 0 | 0 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.111U | 0.110U | 0 | 0 | 0.115U | 0.115U | 0 | 0 |
| 9Cl-PF3ONS | 0.111U | 0.110U | 0 | 0 | 0.115U | 0.115U | 0 | 0 |
| ADONA | 0.056U | 0.055U | 0 | 0 | 0.058U | 0.057U | 0 | 0 |
| NEtFOSAA | 0.111U | 0.110U | 0 | 0 | 0.115U | 0.115U | 0 | 0 |
| NMeFOSAA | 0.056U | 0.055U | 0 | 0 | 0.058U | 0.057U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.556U | 0.552U | 0 | 0 | 0.576U | 0.575U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 0.056U | 0.055U | 0 | 0 | 0.058U | 0.057U | 0 | 0 |
| Perfluorobutanoic acid (PFBA) | 0.111U | 0.055J | 0.055 | 200 | 0.115U | 0.115U | 0 | 0 |
| Perfluorodecane sulfonic acid (PFDS) | 0.111U | 0.110U | 0 | 0 | 0.115U | 0.115U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 0.111U | 0.110U | 0 | 0 | 0.115U | 0.115U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 0.056U | 0.055U | 0 | 0 | 0.058U | 0.057U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 0.056U | 0.038J | 0.038 | 200 | 0.058U | 0.057U | 0 | 0 |
| Perfluoroheptanoic acid (PFHpA) | 0.056U | 0.038J | 0.038 | 200 | 0.058U | 0.057U | 0 | 0 |
| Perfluorohexanesulfonic acid (PFHxS) | 0.062J | 0.196J | 0.134 | 103.9 | 0.115U | 0.115U | 0 | 0 |
| Perfluorohexanoic acid (PFHxA) | 0.056U | 0.290J | 0.29 | 200 | 0.058U | 0.057U | 0 | 0 |
| Perfluorononanesulfonic acid (PFNS) | 0.111U | 0.110U | 0 | 0 | 0.115U | 0.115U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 0.056U | 0.055U | 0 | 0 | 0.058U | 0.057U | 0 | 0 |
| Perfluorooctane Sulfonamide (FOSA) | 0.056U | 0.055U | 0 | 0 | 0.058U | 0.057U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 3.78 | 10.3 | 6.52 | 92.6 | 0.171J | 0.062J | -0.109 | 93.6 |
| Perfluorooctanoic acid (PFOA) | 0.222U | 0.221U | 0 | 0 | 0.230U | 0.230U | 0 | 0 |
| Perfluoropentanesulfonic acid (PFPeS) | 0.056U | 0.055U | 0 | 0 | 0.058U | 0.057U | 0 | 0 |
| Perfluoropentanoic acid (PFPeA) | 0.056U | 0.114J | 0.114 | 200 | 0.058U | 0.057U | 0 | 0 |
| Perfluorotetradecanoic acid (PFTA) | 0.056U | 0.055U | 0 | 0 | 0.058U | 0.057U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 0.111U | 0.110U | 0 | 0 | 0.115U | 0.115U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 0.056U | 0.055U | 0 | 0 | 0.058U | 0.057U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| **Client ID** | SB-VRTB-03_30-30.5 | | | | SB-VRTB-03_36-36.5 | | | |
|---|---|---|---|---|---|---|---|---|
| **LAB ID** | 22110171307 | | | | 22110171308 | | | |
| **Collected** | 09/15/21 10:45 | | | | 09/15/21 11:42 | | | |
| **Matrix** | Solid | | | | Solid | | | |
| **Units** | ug/Kg | | | | ug/Kg | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 0.221U | 0.221U | 0 | 0 | 0.225U | 0.227U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 0.221U | 0.221U | 0 | 0 | 0.225U | 0.227U | 0 | 0 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 0.110U | 0.110U | 0 | 0 | 0.112U | 0.113U | 0 | 0 |
| 9Cl-PF3ONS | 0.110U | 0.110U | 0 | 0 | 0.112U | 0.113U | 0 | 0 |
| ADONA | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |
| NEtFOSAA | 0.110U | 0.110U | 0 | 0 | 0.112U | 0.113U | 0 | 0 |
| NMeFOSAA | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 0.552U | 0.552U | 0 | 0 | 0.562U | 0.567U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |
| Perfluorobutanoic acid (PFBA) | 0.110U | 0.110U | 0 | 0 | 0.112U | 0.113U | 0 | 0 |
| Perfluorodecane sulfonic acid (PFDS) | 0.110U | 0.110U | 0 | 0 | 0.112U | 0.113U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 0.110U | 0.110U | 0 | 0 | 0.112U | 0.113U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |
| Perfluoroheptanoic acid (PFHpA) | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |
| Perfluorohexanesulfonic acid (PFHxS) | 0.110U | 0.043J | 0.043 | 200 | 0.112U | 0.113U | 0 | 0 |
| Perfluorohexanoic acid (PFHxA) | 0.055U | 0.035J | 0.035 | 200 | 0.056U | 0.057U | 0 | 0 |
| Perfluorononanesulfonic acid (PFNS) | 0.110U | 0.110U | 0 | 0 | 0.112U | 0.113U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |
| Perfluorooctane Sulfonamide (FOSA) | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 0.387J | 0.641J | 0.254 | 49.4 | 0.225U | 0.227U | 0 | 0 |
| Perfluorooctanoic acid (PFOA) | 0.221U | 0.221U | 0 | 0 | 0.225U | 0.227U | 0 | 0 |
| Perfluoropentanesulfonic acid (PFPeS) | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |
| Perfluoropentanoic acid (PFPeA) | 0.055U | 0.027J | 0.027 | 200 | 0.056U | 0.057U | 0 | 0 |
| Perfluorotetradecanoic acid (PFTA) | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 0.110U | 0.110U | 0 | 0 | 0.112U | 0.113U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 0.055U | 0.055U | 0 | 0 | 0.056U | 0.057U | 0 | 0 |

Chain of Custody

Pace Analytical
www.pacelabs.com

Workorder: WI18011 Workorder Name: ESTCP GAAF Owner Received Date: 9/18/2021 Results Requested By: 10/29/2021

| Report To: | Subcontract To: | Requested Analysis |
|---|---|---|
| Kathy E. Smith<br>Pace Analytical<br>106 Vantage Point Drive<br>Columbia SC, 29223<br>803-227-2704<br>Kathy.Smith@pacelabs.com | Project #<br><br>Pace Gulf Coast<br>7979 Innovation Park Drive,<br>Baton Rouge, LA 70820 | |

| Item | Sample ID | Sample Type | Collect Date/Time | Lab ID | Matrix | Preserved Containers | TOP Assay | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|
| 1 | SB-VRTB-03_13.75-14 | grab | 09/14/2021 @ 1240 | WI18011-005 | Solid | | x | 1 |
| 2 | SB-VRTB-03_14.75-15 | grab | 09/14/2021 @ 1250 | WI18011-008 | Solid | | x | 2 |
| 3 | SB-VRTB-03_16.5-17 | grab | 09/14/2021 @ 1430 | WI18011-012 | Solid | | x | 3 |
| 4 | SB-VRTB-03_19-19.5 | grab | 09/14/2021 @ 1448 | WI18011-015 | Solid | | x | 4 |
| 5 | SB-VRTB-03_22.5-23 | grab | 09/14/2021 @ 1555 | WI18011-017 | Solid | | x | 5 |
| 6 | SB-VRTB-03_26-26.5 | grab | 09/15/2021 @ 0940 | WI18011-019 | Solid | | x | 6 |
| 7 | SB-VRTB-03_30-30.5 | grab | 09/15/2021 @ 1045 | WI18011-021 | Solid | | x | 7 |
| 8 | SB-VRTB-03_36-36.5 | grab | 09/15/2021 @ 1142 | WI18011-025 | Solid | | x | 8 |
| 9 | | | | | | | | |
| 10 | | | | | | | | |

| Transfers | Released By | Date/Time | Reveived By | Date/Time | Comments |
|---|---|---|---|---|---|
| 1 | | 10/13/21 1900 | | | 1663 3465 9940 1663 3466 0222 |
| 2 | FedEX | 10/14/21 1100 | | 10/14/21 1100 | 0.4E34 2.4f 34 |
| 3 | | | | | |

**Cooler Temperature on Receipt** _____ °C **Custody Seal Y or N** **Received on**

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signa

This chain of custody is considered complete as is since this information is available in the owner laboratory

Client ID: 4367 - Pace Analytical Services
SDG: 221101713
PM: EPM

Friday, June 17, 2016 11:01:34 AM FMT-ALL-C-002rev.0

# SAMPLE RECEIVING CHECKLIST

| SAMPLE DELIVERY GROUP 221101713 | |
|---|---|
| **Client** **PM** EPM<br>4367 - Pace Analytical Services | **Transport Method**<br>FEDEX |
| **Profile Number**<br>294268 | **Received By**<br>Henderson, Jacob R. |
| **Line Item(s)**<br>3 - TOP Assay | **Receive Date(s)**<br>10/14/21 |

| CHECKLIST | YES | NO |
|---|---|---|
| Samples received with proper thermal preservation? | ☑ | ☐ |
| Radioactivity is <1600 cpm? If no, record cpm value in notes section. | ☑ | ☐ |
| COC relinquished and complete (including sampleIDs, collect times, and sampler)? | ☑ | ☐ |
| All containers received in good condition and within hold time? | ☑ | ☐ |
| All sample labels and containers received match the chain of custody? | ☑ | ☐ |
| Preservative added to any containers? | ☐ | ☑ |
| If received, was headspace for VOC water containers < 6mm? | ☑ | ☐ |
| Samples collected in containers provided by Pace Gulf Coast? | ☑ | ☐ |

**COOLERS**

| Airbill | Thermometer ID: E34 | Temp °C |
|---|---|---|
| 1663 3465 9940 | | 0.4 |
| 1663 3466 0222 | | 2.4 |

**DISCREPANCIES**

None

**LAB PRESERVATIONS**

None

**NOTES**

# Appendix C-3 Groundwater Samples: Performance Monitoring

# Performance Monitoring Event #1

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

March 09, 2022

Kathy Smith
Pace South Carolina
106 Vantage Point Drive
West Columbia, SC 29172

RE: Project: WL27010-Revised Report
Pace Project No.: 10593493

Dear Kathy Smith:

Enclosed are the analytical results for sample(s) received by the laboratory on January 05, 2022. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Minneapolis

This report was revised March 9, 2022, to report to the MDL.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kirsten Hogberg
kirsten.hogberg@pacelabs.com
(612)607-1700
Project Manager

Enclosures



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

# CERTIFICATIONS

Project: WL27010-Revised Report
Pace Project No.: 10593493

**Pace Analytical Services, LLC - Minneapolis MN**

1700 Elm Street SE, Minneapolis, MN 55414
1800 Elm Street SE, Minneapolis, MN 55414--Satellite Air Lab
A2LA Certification #: 2926.01*
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: 17-009*
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014*
Arkansas DW Certification #: MN00064
Arkansas WW Certification #: 88-0680
California Certification #: 2929
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
EPA Region 8 Tribal Water Systems+Wyoming DW Certification #: via MN 027-053-137
Florida Certification #: E87605*
Georgia Certification #: 959
Hawaii Certification #: MN00064
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: AI-03086*
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064*
Maryland Certification #: 322
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137*
Minnesota Dept of Ag Approval: via MN 027-053-137
Minnesota Petrofund Registration #: 1240*
Mississippi Certification #: MN00064
Missouri Certification #: 10100
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081*
New Jersey Certification #: MN002
New York Certification #: 11647*
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification (1700) #: CL101
Ohio VAP Certification (1800) #: CL110*
Oklahoma Certification #: 9507*
Oregon Primary Certification #: MN300001
Oregon Secondary Certification #: MN200001*
Pennsylvania Certification #: 68-00563*
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192*
Utah Certification #: MN00064*
Vermont Certification #: VT-027053137
Virginia Certification #: 460163*
Washington Certification #: C486*
West Virginia DEP Certification #: 382
West Virginia DW Certification #: 9952 C
Wisconsin Certification #: 999407970
Wyoming UST Certification #: via A2LA 2926.01
USDA Permit #: P330-19-00208
*Please Note: Applicable air certifications are denoted with an asterisk (*).



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## SAMPLE SUMMARY

Project: WL27010-Revised Report
Pace Project No.: 10593493

| Lab ID | Sample ID | Matrix | Date Collected | Date Received |
|---|---|---|---|---|
| **10593493001** | **CMT-VRTB-01-1_12172021** | Water | 12/17/21 15:13 | 01/05/22 14:05 |
| **10593493002** | **CMT-VRTB-01-2_12172021** | Water | 12/17/21 14:00 | 01/05/22 14:05 |
| **10593493003** | **CMT-VRTB-01-3_12172021** | Water | 12/17/21 11:57 | 01/05/22 14:05 |
| **10593493004** | **CMT-VRTB-01-4_12172021** | Water | 12/17/21 11:18 | 01/05/22 14:05 |
| **10593493005** | **CMT-VRTB-01-5_12172021** | Water | 12/17/21 14:16 | 01/05/22 14:05 |
| **10593493006** | **CMT-VRTB-01-6_12172021** | Water | 12/17/21 11:55 | 01/05/22 14:05 |
| **10593493007** | **CMT-VRTB-01-7_12172021** | Water | 12/17/21 11:10 | 01/05/22 14:05 |



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## SAMPLE ANALYTE COUNT

Project: WL27010-Revised Report
Pace Project No.: 10593493

| Lab ID | Sample ID | Method | Analysts | Analytes Reported |
|---|---|---|---|---|
| **10593493001** | **CMT-VRTB-01-1_12172021** | True TOF | AR3 | 3 |
| **10593493002** | **CMT-VRTB-01-2_12172021** | True TOF | AR3 | 3 |
| **10593493003** | **CMT-VRTB-01-3_12172021** | True TOF | AR3 | 3 |
| **10593493004** | **CMT-VRTB-01-4_12172021** | True TOF | AR3 | 3 |
| **10593493005** | **CMT-VRTB-01-5_12172021** | True TOF | AR3 | 3 |
| **10593493006** | **CMT-VRTB-01-6_12172021** | True TOF | AR3 | 3 |
| **10593493007** | **CMT-VRTB-01-7_12172021** | True TOF | AR3 | 3 |

PASI-M = Pace Analytical Services - Minneapolis



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## SUMMARY OF DETECTION

Project: WL27010-Revised Report
Pace Project No.: 10593493

| Lab Sample ID / Method | Client Sample ID / Parameters | Result | Units | Report Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|---|
| **10593493001** | **CMT-VRTB-01-1_12172021** | | | | | |
| True TOF | Free Fluoride | 0.022J | mg/L | 0.050 | 01/12/22 17:26 | N2 |
| **10593493002** | **CMT-VRTB-01-2_12172021** | | | | | |
| True TOF | Free Fluoride | 0.049J | mg/L | 0.050 | 01/12/22 18:12 | N2 |
| True TOF | Total Fluorine | 0.058J | mg/L | 0.10 | 01/12/22 18:12 | N2 |
| **10593493003** | **CMT-VRTB-01-3_12172021** | | | | | |
| True TOF | Free Fluoride | 0.045J | mg/L | 0.050 | 01/12/22 18:57 | N2 |
| True TOF | Total Fluorine | 0.051J | mg/L | 0.10 | 01/12/22 18:57 | N2 |
| **10593493004** | **CMT-VRTB-01-4_12172021** | | | | | |
| True TOF | Free Fluoride | 0.044J | mg/L | 0.050 | 01/12/22 19:42 | N2 |
| True TOF | Total Fluorine | 0.036J | mg/L | 0.10 | 01/12/22 19:42 | N2 |
| **10593493005** | **CMT-VRTB-01-5_12172021** | | | | | |
| True TOF | Free Fluoride | 0.042J | mg/L | 0.050 | 01/12/22 20:28 | N2 |
| True TOF | Total Fluorine | 0.047J | mg/L | 0.10 | 01/12/22 20:28 | N2 |
| **10593493006** | **CMT-VRTB-01-6_12172021** | | | | | |
| True TOF | Free Fluoride | 0.034J | mg/L | 0.050 | 01/12/22 21:13 | N2 |
| **10593493007** | **CMT-VRTB-01-7_12172021** | | | | | |
| True TOF | Free Fluoride | 0.035J | mg/L | 0.050 | 01/12/22 21:58 | N2 |



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

# PROJECT NARRATIVE

Project: WL27010-Revised Report
Pace Project No.: 10593493

**Method:** **True TOF**
**Description:** Total Organofluorine
**Client:** Pace West Columbia,SC
**Date:** March 09, 2022

**General Information:**
7 samples were analyzed for True TOF by Pace Analytical Services Minneapolis. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

**Hold Time:**
The samples were analyzed within the method required hold times with any exceptions noted below.

**Method Blank:**
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

**Laboratory Control Spike:**
All laboratory control spike compounds were within QC limits with any exceptions noted below.

**Matrix Spikes:**
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

**Additional Comments:**

Analyte Comments:

QC Batch: 793374

N2: The lab does not hold NELAC/TNI accreditation for this parameter but other accreditations/certifications may apply. A complete list of accreditations/certifications is available upon request.

- BLANK (Lab ID: 4220074)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- CMT-VRTB-01-1_12172021 (Lab ID: 10593493001)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- CMT-VRTB-01-2_12172021 (Lab ID: 10593493002)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- CMT-VRTB-01-3_12172021 (Lab ID: 10593493003)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- CMT-VRTB-01-4_12172021 (Lab ID: 10593493004)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- CMT-VRTB-01-5_12172021 (Lab ID: 10593493005)
  - Free Fluoride



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

# PROJECT NARRATIVE

Project: WL27010-Revised Report
Pace Project No.: 10593493

**Method:** **True TOF**
**Description:** Total Organofluorine
**Client:** Pace West Columbia,SC
**Date:** March 09, 2022

Analyte Comments:

QC Batch: 793374

N2: The lab does not hold NELAC/TNI accreditation for this parameter but other accreditations/certifications may apply. A complete list of accreditations/certifications is available upon request.

- CMT-VRTB-01-5_12172021 (Lab ID: 10593493005)
  - Total Fluorine
  - Total Organofluorine
- CMT-VRTB-01-6_12172021 (Lab ID: 10593493006)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- CMT-VRTB-01-7_12172021 (Lab ID: 10593493007)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- LCS (Lab ID: 4220075)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- MS (Lab ID: 4220076)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine
- MSD (Lab ID: 4220077)
  - Free Fluoride
  - Total Fluorine
  - Total Organofluorine

This data package has been reviewed for quality and completeness and is approved for release.



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## ANALYTICAL RESULTS

Project: WL27010-Revised Report
Pace Project No.: 10593493

**Sample: CMT-VRTB-01-1_12172021** **Lab ID: 10593493001** Collected: 12/17/21 15:13 Received: 01/05/22 14:05 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | | |
| Free Fluoride | **0.022J** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 17:26 | | N2 |
| Total Fluorine | **<0.032** | mg/L | 0.10 | 0.032 | 1 | | 01/12/22 17:26 | | N2 |
| Total Organofluorine | **<0.016** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 17:26 | | N2 |

**Sample: CMT-VRTB-01-2_12172021** **Lab ID: 10593493002** Collected: 12/17/21 14:00 Received: 01/05/22 14:05 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | | |
| Free Fluoride | **0.049J** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 18:12 | | N2 |
| Total Fluorine | **0.058J** | mg/L | 0.10 | 0.032 | 1 | | 01/12/22 18:12 | | N2 |
| Total Organofluorine | **<0.016** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 18:12 | | N2 |

**Sample: CMT-VRTB-01-3_12172021** **Lab ID: 10593493003** Collected: 12/17/21 11:57 Received: 01/05/22 14:05 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | | |
| Free Fluoride | **0.045J** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 18:57 | | N2 |
| Total Fluorine | **0.051J** | mg/L | 0.10 | 0.032 | 1 | | 01/12/22 18:57 | | N2 |
| Total Organofluorine | **<0.016** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 18:57 | | N2 |

**Sample: CMT-VRTB-01-4_12172021** **Lab ID: 10593493004** Collected: 12/17/21 11:18 Received: 01/05/22 14:05 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | | |
| Free Fluoride | **0.044J** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 19:42 | | N2 |
| Total Fluorine | **0.036J** | mg/L | 0.10 | 0.032 | 1 | | 01/12/22 19:42 | | N2 |
| Total Organofluorine | **<0.016** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 19:42 | | N2 |

## REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## ANALYTICAL RESULTS

Project: WL27010-Revised Report
Pace Project No.: 10593493

**Sample: CMT-VRTB-01-5_12172021** **Lab ID: 10593493005** Collected: 12/17/21 14:16 Received: 01/05/22 14:05 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | | |
| Free Fluoride | **0.042J** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 20:28 | | N2 |
| Total Fluorine | **0.047J** | mg/L | 0.10 | 0.032 | 1 | | 01/12/22 20:28 | | N2 |
| Total Organofluorine | **<0.016** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 20:28 | | N2 |

**Sample: CMT-VRTB-01-6_12172021** **Lab ID: 10593493006** Collected: 12/17/21 11:55 Received: 01/05/22 14:05 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | | |
| Free Fluoride | **0.034J** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 21:13 | | N2 |
| Total Fluorine | **<0.032** | mg/L | 0.10 | 0.032 | 1 | | 01/12/22 21:13 | | N2 |
| Total Organofluorine | **<0.016** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 21:13 | | N2 |

**Sample: CMT-VRTB-01-7_12172021** **Lab ID: 10593493007** Collected: 12/17/21 11:10 Received: 01/05/22 14:05 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Total Organofluorine** | Analytical Method: True TOF<br>Pace Analytical Services - Minneapolis | | | | | | | | |
| Free Fluoride | **0.035J** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 21:58 | | N2 |
| Total Fluorine | **<0.032** | mg/L | 0.10 | 0.032 | 1 | | 01/12/22 21:58 | | N2 |
| Total Organofluorine | **<0.016** | mg/L | 0.050 | 0.016 | 1 | | 01/12/22 21:58 | | N2 |



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## QUALITY CONTROL DATA

Project: WL27010-Revised Report
Pace Project No.: 10593493

QC Batch: 793374
QC Batch Method: True TOF
Analysis Method: True TOF
Analysis Description: Total Organofluorine
Laboratory: Pace Analytical Services - Minneapolis
Associated Lab Samples: 10593493001, 10593493002, 10593493003, 10593493004, 10593493005, 10593493006, 10593493007

METHOD BLANK: 4220074 Matrix: Water
Associated Lab Samples: 10593493001, 10593493002, 10593493003, 10593493004, 10593493005, 10593493006, 10593493007

| Parameter | Units | Blank Result | Reporting Limit | MDL | Analyzed | Qualifiers |
|---|---|---|---|---|---|---|
| Free Fluoride | mg/L | <0.016 | 0.050 | 0.016 | 01/13/22 02:30 | N2 |
| Total Fluorine | mg/L | <0.032 | 0.10 | 0.032 | 01/13/22 02:30 | N2 |
| Total Organofluorine | mg/L | <0.016 | 0.050 | 0.016 | 01/13/22 02:30 | N2 |

LABORATORY CONTROL SAMPLE: 4220075

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Free Fluoride | mg/L | 1 | 0.94 | 94 | 75-125 | N2 |
| Total Fluorine | mg/L | 2 | 2.0 | 101 | 75-125 | N2 |
| Total Organofluorine | mg/L | 1 | 1.1 | 107 | 75-125 | N2 |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 4220076 4220077

| Parameter | Units | 10593493001 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Free Fluoride | mg/L | 0.022J | 1 | 1 | 1.0 | 1.1 | 103 | 104 | 50-150 | 2 | 20 | N2 |
| Total Fluorine | mg/L | <0.032 | 2 | 2 | 2.0 | 2.1 | 99 | 104 | 50-150 | 5 | 20 | N2 |
| Total Organofluorine | mg/L | <0.016 | 1 | 1 | 0.95 | 1.0 | 95 | 103 | 50-150 | 8 | 20 | N2 |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**

## REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

# QUALIFIERS

Project: WL27010-Revised Report
Pace Project No.: 10593493

## DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

## ANALYTE QUALIFIERS

| | |
|---|---|
| N2 | The lab does not hold NELAC/TNI accreditation for this parameter but other accreditations/certifications may apply. A complete list of accreditations/certifications is available upon request. |



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

**Pace Analytical Services, LLC**
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

## QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: WL27010-Revised Report
Pace Project No.: 10593493

| Lab ID | Sample ID | QC Batch Method | QC Batch | Analytical Method | Analytical Batch |
|---|---|---|---|---|---|
| **10593493001** | **CMT-VRTB-01-1_12172021** | True TOF | 793374 | | |
| **10593493002** | **CMT-VRTB-01-2_12172021** | True TOF | 793374 | | |
| **10593493003** | **CMT-VRTB-01-3_12172021** | True TOF | 793374 | | |
| **10593493004** | **CMT-VRTB-01-4_12172021** | True TOF | 793374 | | |
| **10593493005** | **CMT-VRTB-01-5_12172021** | True TOF | 793374 | | |
| **10593493006** | **CMT-VRTB-01-6_12172021** | True TOF | 793374 | | |
| **10593493007** | **CMT-VRTB-01-7_12172021** | True TOF | 793374 | | |



This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

WO# : 10593493

10593493

Chain of Custody

Pace Analytical®
www.pacelabs.com

Workorder: WL27010 Workorder Name: ESTCP Vertebrae Owner Received Date: 12/29/2021 Results Requested By: 1/10/2022

| Report To: | Subcontract To: |
|---|---|
| Kathy E. Smith<br>Pace Analytical<br>106 Vantage Point Drive<br>Columbia SC, 29223<br>803-227-2704<br>Kathy.Smith@pacelabs.com | Project #<br><br>Pace MN<br>1700 Elm St SE, Suite 200<br>Minneapolis, MN 55414 |

| Item | Sample ID | Sample Type | Collect Date/Time | Lab ID | Matrix | Preserved Containers: UP | Requested Analysis: True TOF | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|
| 1 | CMT-VRTB-01-1_12172021 | grab | 12/17/2021 @ 1513 | WL27010-004 | Aqueous | X | X | 001 |
| 2 | CMT-VRTB-01-2_12172021 | grab | 12/17/2021 @ 1400 | WL27010-005 | Aqueous | X | X | 002 |
| 3 | CMT-VRTB-01-3_12172021 | grab | 12/17/2021 @ 1157 | WL27010-006 | Aqueous | X | X | 003 |
| 4 | CMT-VRTB-01-4_12172021 | grab | 12/17/2021 @ 1118 | WL27010-007 | Aqueous | X | X | 004 |
| 5 | CMT-VRTB-01-5_12172021 | grab | 12/17/2021 @ 1416 | WL27010-008 | Aqueous | X | X | 005 |
| 6 | CMT-VRTB-01-6_12172021 | grab | 12/17/2021 @ 1155 | WL27010-009 | Aqueous | X | X | 006 |
| 7 | CMT-VRTB-01-7_12172021 | grab | 12/17/2021 @ 1110 | WL27010-010 | Aqueous | X | X | 007 |
| 8 | | | | | | | | |
| 9 | **may have high levels of PFAS*** | | | | | | | |
| 10 | | | | | | | | |

| Transfers | Released By | Date/Time | Reveived By | Date/Time | Comments |
|---|---|---|---|---|---|
| 1 | [signature] | 1/4/22 1700 | [signature]/PACE | 1/5/22 1405 | |
| 2 | | | | | |
| 3 | | | | | |

Cooler Temperature on Receipt 1.8 °C | Custody Seal (Y) or N | Received on Ice (Y) or N | Sample Intact (Y) or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document. This chain of custody is considered complete as is since this information is available in the owner laboratory.

Friday, June 17, 2016 11:01:34 AM

FMT-ALL-C-002rev.00 24March2009

| Pace Analytical | Document Name: Sample Condition Upon Receipt (SCUR) - MN | Document Revised: 02Dec2021 Page 1 of 1 |
|---|---|---|
| | Document No.: ENV-FRM-MIN4-0150 Rev.03 | Pace Analytical Services - Minneapolis |

**Sample Condition Upon Receipt**

**Client Name:** Pace Columbia SC

**Project #:** **WO# : 10593493**

**PM: KNH** **Due Date: 01/26/22**

**CLIENT: Shealy Env**

**Courier:** ☒Fed Ex ☐UPS ☐USPS ☐Client ☐Pace ☐SpeeDee ☐Commercial

**Tracking Number:** 1663 3466 3107 **See Exceptions** ☐ **ENV-FRM-MIN4-0142**

**Custody Seal on Cooler/Box Present?** ☒Yes ☐No **Seals Intact?** ☒Yes ☐No **Biological Tissue Frozen?** ☐Yes ☐No ☒N/A

**Packing Material:** ☐Bubble Wrap ☐Bubble Bags ☒None ☐Other:_____ **Temp Blank?** ☒Yes ☐No

**Thermometer:** ☐T1(0461) ☐T2(1336) ☒T3(0459) ☐T4(0254) ☐T5(0489) ☐01339252/1710 ☐122639816 ☐140792808 **Type of Ice:** ☒Wet ☐Blue ☐None ☐Dry ☐Melted

**Did Samples Originate in West Virginia?** ☐Yes ☒No **Were All Container Temps Taken?** ☐Yes ☐No ☒N/A

Temp should be above freezing to 6°C **Cooler Temp Read w/temp blank:** 1.8 °C **Average Corrected Temp (no temp blank only):** _____ °C ☐See Exceptions ENV-FRM-MIN4-0142 ☐1 Container

**Correction Factor:** None **Cooler Temp Corrected w/temp blank:** 1.8 °C

**USDA Regulated Soil:** ( ☒N/A, water sample/Other:_____) **Date/Initials of Person Examining Contents:** LAD 1/5/22

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA. MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐Yes ☐No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐Yes ☐No

**If Yes to either question, fill out a Regulated Soil Checklist ENV-FRM-MIN4-0154and include with SCUR/COC paperwork.**

| | | | | COMMENTS: |
|---|---|---|---|---|
| Chain of Custody Present and Filled Out? | ☒Yes | ☐No | | 1. |
| Chain of Custody Relinquished? | ☒Yes | ☐No | | 2. |
| Sampler Name and/or Signature on COC? | ☐Yes | ☐No | ☒N/A | 3. |
| Samples Arrived within Hold Time? | ☒Yes | ☐No | | 4. If Fecal: ☐<8 hrs ☐>8hr, <24 hrs, ☐>24 hrs |
| **Short Hold Time Analysis (<72 hr)?** | ☐Yes | ☒No | | 5. ☐Fecal Coliform ☐HPC ☐Total Coliform/E coli ☐BOD/cBOD ☐Hex Chrome ☐Turbidity ☐Nitrate ☐Nitrite ☐Orthophos ☐Other_____ |
| **Rush Turn Around Time Requested?** | ☒Yes | ☐No | | 6. 1/10/22 |
| Sufficient Volume? | ☒Yes | ☐No | | 7. |
| Correct Containers Used? | ☒Yes | ☐No | | 8. |
| -Pace Containers Used? | ☐Yes | ☒No | | |
| Containers Intact? | ☒Yes | ☐No | | 9. |
| Field Filtered Volume Received for Dissolved Tests? | ☐Yes | ☐No | ☒N/A | 10. Is sediment visible in the dissolved container? ☐Yes ☐No |
| Is sufficient information available to reconcile the samples to the COC? Matrix: ☒Water ☐Soil ☐Oil ☐Other- | ☒Yes | ☐No | | 11. **If no, write ID/ Date/Time on Container Below:** **See Exception** ☐ **ENV-FRM-MIN4-0142** |
| All containers needing acid/base preservation have been checked? | ☐Yes | ☐No | ☒N/A | 12. Sample # |
| All containers needing preservation are found to be in compliance with EPA recommendation? ($HNO_3$, $H_2SO_4$, <2pH, NaOH >9 Sulfide, NaOH>10 Cyanide) | ☐Yes | ☐No | ☒N/A | ☐NaOH ☐$HNO_3$ ☐$H_2SO_4$ ☐Zinc Acetate |
| Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin/PFAS | ☐Yes | ☐No | ☒N/A | Positive for Res. Chlorine? ☐Yes ☐No **pH Paper Lot#** **See Exception** ☐ **ENV-FRM-MIN4-0142** |
| | | | | Res. Chlorine \| 0-6 Roll \| 0-6 Strip \| 0-14 Strip |
| Headspace in Methyl Mercury Container? | ☐Yes | ☐No | ☒N/A | |
| Extra labels present on soil VOA or WIDRO containers? | ☐Yes | ☐No | ☒N/A | 13. **See Exception** ☐ **ENV-FRM-MIN4-0140** |
| Headspace in VOA Vials (greater than 6mm)? | ☐Yes | ☐No | ☒N/A | |
| Trip Blank Present? | ☐Yes | ☐No | ☒N/A | 14. |
| Trip Blank Custody Seals Present? | ☐Yes | ☐No | ☒N/A | Pace Trip Blank Lot # (if purchased):_____ |

**CLIENT NOTIFICATION/RESOLUTION** **Field Data Required?** ☐Yes ☐No

Person Contacted: _____ Date/Time: _____

Comments/Resolution: _____

**Project Manager Review:** Kirsten Hogberg **Date:** 1/6/22

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e., out of hold, incorrect preservative, out of temp, incorrect containers).

Labeled by: HB (2)

*LELAP CERTIFICATE NUMBER: 01955*
*DOD-ELAP ACCREDITATION NUMBER: 74960*

# ANALYTICAL RESULTS

**PERFORMED BY**

**Pace Analytical Gulf Coast**
**7979 Innovation Park Dr.**
**Baton Rouge, LA 70820**
**(225) 769-4900**

**Report Date** 02/10/2022

**Report #** 222010533

***Project*** WL27010 ESTCP Vertebrae

**Samples Collected** 12/17/21

| ***Deliver To*** | ***Additional Recipients*** |
|---|---|
| Kathy Smith<br>Pace Analytical<br>106 Vantage Point Drive<br>Columbia, SC 29223<br>803-227-2704 | NONE |

# Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with Pace Gulf Coast's Standard Operating Procedures.

**Common Abbreviations that may be Utilized in this Report**

| | |
|---|---|
| **ND** | Indicates the result was Not Detected at the specified reporting limit |
| **NO** | Indicates the sample did not ignite when preliminary test performed for EPA Method 1030 |
| **DO** | Indicates the result was Diluted Out |
| **MI** | Indicates the result was subject to Matrix Interference |
| **TNTC** | Indicates the result was Too Numerous To Count |
| **SUBC** | Indicates the analysis was Sub-Contracted |
| **FLD** | Indicates the analysis was performed in the Field |
| **DL** | Detection Limit |
| **LOD** | Limit of Detection |
| **LOQ** | Limit of Quantitation |
| **RE** | Re-analysis |
| **CF** | HPLC or GC Confirmation |
| **00:01** | Reported as a time equivalent to 12:00 AM |

**Reporting Flags that may be Utilized in this Report**

| | |
|---|---|
| **J or I** | Indicates the result is between the MDL and LOQ |
| **J** | DOD flag on analyte in the parent sample for MS/MSD outside acceptance criteria |
| **U** | Indicates the compound was analyzed for but not detected |
| **B or V** | Indicates the analyte was detected in the associated Method Blank |
| **Q** | Indicates a non-compliant QC Result (See Q Flag Application Report) |
| ***** | Indicates a non-compliant or not applicable QC recovery or RPD – see narrative |
| **E** | Organics **-** The result is estimated because it exceeded the instrument calibration range |
| **E** | Metals - % diference for the serial dilution is > 10% |
| **L** | Reporting Limits adjusted to meet risk-based limit. |
| **P** | RPD between primary and confirmation result is greater than 40 |
| **DL** | Diluted analysis – when appended to Client Sample ID |

Sample receipt at Pace Gulf Coast is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of Pace Gulf Coast. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with The NELAC Institute (TNI) Standard 2009 and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.



Authorized Signature
Pace Gulf Coast Report 222010533

# Certifications

| Certification | Certification Number |
|---|---|
| DOD ELAP | 74960 |
| Alabama | 01955 |
| Arkansas | 88-0655 |
| Colorado | 01955 |
| Delaware | 01955 |
| Florida | E87854 |
| Georgia | 01955 |
| Hawaii | 01955 |
| Idaho | 01955 |
| Illinois | 200048 |
| Indiana | 01955 |
| Kansas | E-10354 |
| Kentucky | 95 |
| Louisiana | 01955 |
| Maryland | 01955 |
| Massachusetts | 01955 |
| Michigan | 01955 |
| Mississippi | 01955 |
| Missouri | 01955 |
| Montana | N/A |
| Nebraska | 01955 |
| New Mexico | 01955 |
| North Carolina | 618 |
| North Dakota | R-195 |
| Oklahoma | 9403 |
| South Carolina | 73006001 |
| South Dakota | 01955 |
| Tennessee | 01955 |
| Texas | T104704178 |
| Vermont | 01955 |
| Virginia | 460215 |
| Washington | C929 |
| USDA Soil Permit | P330-16-00234 |

# Case Narrative

**Client:** Pace Analytical Services **Report:** 222010533

Pace Analytical Gulf Coast received and analyzed the sample(s) listed on the Report Sample Summary page of this report. Receipt of the sample(s) is documented by the attached chain of custody. This applies only to the sample(s) listed in this report. No sample integrity or quality control exceptions were identified unless noted below.

This report was completed in accordance with DOD QSM 5.3 as specified in the contract.

**SEMI-VOLATILES MASS SPECTROMETRY**

Samples 22201053301 (CMT-VRTB-01-1_12172021), 22201053302 (CMT-VRTB-01-2_12172021) and 22201053303 (CMT-VRTB-01-3_12172021) were re-extracted outside holding time for contamination of PFBA and PFPeA in the oxidation reagent blank. In addition, 22201053301 (CMT-VRTB-01-1_12172021) did not appear to fully oxidize due to the presence of 6:2FTS at the same concentration in the Pre and Post Top Assay analysis. Both data sets are being reported

Samples 22201053304 (CMT-VRTB-01-4_12172021), 22201053305 (CMT-VRTB-01-5_12172021), 22201053306 (CMT-VRTB-01-6_12172021) and 22201053307 (CMT-VRTB-01-7_12172021) were re-extracted outside holding time due to contamination in the oxidation blank greater than the reporting limit for compounds PFBA, PFPeA and PFHxA.

Sample 22201053306 (CMT-VRTB-01-6_12172021) was re-extracted outside holding time due to extracted internal standard failure associated with target compound PFBA. The re-extracted analysis was within control limits

In the PFAS Top Assay QSM B15 (Post) analysis, the recovery for the extracted internal standard MPFBA is outside the control limits for sample 22201053303 (CMT-VRTB-01-3_12172021) .

In the PFAS Top Assay QSM B15 (Post) analysis, the recovery for the extracted internal standard MPFBA is outside the control limits for sample 22201053304 (CMT-VRTB-01-4_12172021) .

In the PFAS Top Assay QSM B15 (Post) analysis, the recovery for the extracted internal standard MPFBA is outside the control limits for sample 22201053307 (CMT-VRTB-01-7_12172021) .

# Sample Summary

| Lab ID | Client ID | Matrix | Collect Date | Receive Date |
|---|---|---|---|---|
| 22201053301 | CMT-VRTB-01-1_12172021 | Water | 12/17/21 15:13 | 1/05/22 10:00 |
| 22201053302 | CMT-VRTB-01-2_12172021 | Water | 12/17/21 14:00 | 1/05/22 10:00 |
| 22201053303 | CMT-VRTB-01-3_12172021 | Water | 12/17/21 11:57 | 1/05/22 10:00 |
| 22201053304 | CMT-VRTB-01-4_12172021 | Water | 12/17/21 11:18 | 1/05/22 10:00 |
| 22201053305 | CMT-VRTB-01-5_12172021 | Water | 12/17/21 14:16 | 1/05/22 10:00 |
| 22201053306 | CMT-VRTB-01-6_12172021 | Water | 12/17/21 11:55 | 1/05/22 10:00 |
| 22201053307 | CMT-VRTB-01-7_12172021 | Water | 12/17/21 11:10 | 1/05/22 10:00 |

# Test Summary

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Matrix | Batch | Instru | RunDate |
|---|---|---|---|---|---|
| 22201053301 | CMT-VRTB-01-1_12172021 | Water | 731514 | QQQ4 | 1/12/22 22:42 |
| 22201053301DL | CMT-VRTB-01-1_12172021DL | Water | 731571 | QQQ4 | 1/13/22 12:48 |
| 22201053302 | CMT-VRTB-01-2_12172021 | Water | 731514 | QQQ4 | 1/12/22 22:56 |
| 22201053302DL | CMT-VRTB-01-2_12172021DL | Water | 731571 | QQQ4 | 1/13/22 13:03 |
| 22201053303 | CMT-VRTB-01-3_12172021 | Water | 731514 | QQQ4 | 1/12/22 23:11 |
| 22201053304 | CMT-VRTB-01-4_12172021 | Water | 731514 | QQQ4 | 1/12/22 23:26 |
| 22201053305 | CMT-VRTB-01-5_12172021 | Water | 731514 | QQQ4 | 1/12/22 23:41 |
| 22201053306 | CMT-VRTB-01-6_12172021 | Water | 731514 | QQQ4 | 1/12/22 23:56 |
| 22201053307 | CMT-VRTB-01-7_12172021 | Water | 731514 | QQQ4 | 1/13/22 00:11 |

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Matrix | Batch | Instru | RunDate |
|---|---|---|---|---|---|
| 22201053301 | CMT-VRTB-01-1_12172021 | Water | 731571 | QQQ4 | 1/13/22 14:20 |
| 22201053301DL | CMT-VRTB-01-1_12172021DL | Water | 732043 | QQQ4 | 1/20/22 13:51 |
| 22201053301RE | CMT-VRTB-01-1_12172021RE | Water | 732043 | QQQ4 | 1/20/22 14:05 |
| 22201053302 | CMT-VRTB-01-2_12172021 | Water | 731745 | QQQ4 | 1/16/22 17:06 |
| 22201053302DL | CMT-VRTB-01-2_12172021DL | Water | 732036 | QQQ4 | 1/18/22 17:45 |
| 22201053302RE | CMT-VRTB-01-2_12172021RE | Water | 732043 | QQQ4 | 1/20/22 14:35 |
| 22201053303 | CMT-VRTB-01-3_12172021 | Water | 731571 | QQQ4 | 1/13/22 15:05 |
| 22201053303RE | CMT-VRTB-01-3_12172021RE | Water | 732043 | QQQ4 | 1/20/22 14:50 |
| 22201053304 | CMT-VRTB-01-4_12172021 | Water | 731571 | QQQ4 | 1/13/22 15:20 |
| 22201053304RE | CMT-VRTB-01-4_12172021RE | Water | 732329 | QQQ4 | 1/25/22 12:02 |
| 22201053305 | CMT-VRTB-01-5_12172021 | Water | 731571 | QQQ4 | 1/13/22 15:35 |
| 22201053305RE | CMT-VRTB-01-5_12172021RE | Water | 732329 | QQQ4 | 1/25/22 12:17 |
| 22201053306 | CMT-VRTB-01-6_12172021 | Water | 731571 | QQQ4 | 1/13/22 16:04 |
| 22201053306RE | CMT-VRTB-01-6_12172021RE | Water | 732329 | QQQ4 | 1/25/22 12:32 |
| 22201053307 | CMT-VRTB-01-7_12172021 | Water | 731571 | QQQ4 | 1/13/22 16:20 |
| 22201053307RE | CMT-VRTB-01-7_12172021RE | Water | 732329 | QQQ4 | 1/25/22 12:46 |

# Manual Integrations

Manual Integrations for LC and IC (if performed) are documented in the raw data.
No other manual integrations were performed by Pace Gulf Coast.

# Q Flag Summary

Client Sample ID: **CMT-VRTB-01-1_12172021** Lab Sample ID: **22201053301**

| **PFAS Top Assay QSM B15 (Post) Analysis Date: 1/13/2022 2:20:27 PM** | | | | | | |
|---|---|---|---|---|---|---|
| **CAS** | **Analyte** | **CCV** | **LCS/D** | **SURR** | **ISTD** | **CLCCV** |
| 763051-92-9 | 11Cl-PF3OUdS | | X | | | |
| 757124-72-4 | 4:2FTS | | X | | | |
| 27619-97-2 | 6:2FTS | | X | | | |
| 39108-34-4 | 8:2FTS | | X | | | |
| 756426-58-1 | 9Cl-PF3ONS | | X | | | |
| 919005-14-4 | ADONA | | X | | | |
| 13252-13-6 | HFPO-DA | | X | | | |
| 2991-50-6 | NEtFOSAA | | X | | | |
| 2355-31-9 | NMeFOSAA | | X | | | |
| 375-22-4 | PFBA | | X | | | |
| 375-73-5 | PFBS | | X | | | |
| 335-76-2 | PFDA | | X | | | |
| 307-55-1 | PFDoA | | X | | | |
| 335-77-3 | PFDS | | X | | | |
| 375-85-9 | PFHpA | | X | | | |
| 375-92-8 | PFHpS | | X | | | |
| 307-24-4 | PFHxA | | X | | | |
| 355-46-4 | PFHxS | | X | | | |
| 375-95-1 | PFNA | | X | | | |
| 68259-12-1 | PFNS | | X | | | |
| 335-67-1 | PFOA | | X | | | |
| 1763-23-1 | PFOS | | X | | | |
| 754-91-6 | PFOSA | | X | | | |
| 2706-90-3 | PFPeA | | X | | | |
| 2706-91-4 | PFPeS | | X | | | |
| 376-06-7 | PFTeDA | | X | | | |
| 72629-94-8 | PFTrDA | | X | | | |
| 2058-94-8 | PFUnA | | X | | | |

CCV=Initial or Continuing CCV out of limits
LCS/D=LCS/LCSD out of limits
SURR=Surrogate out of limits
ISTD=Internal Standard out of limits
CLCCV=Closing CCV out of limits

# Detect Summary

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22201053301 | CMT-VRTB-01-1_12172021 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 23.2Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 4.40JQ | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 52.5Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 63.2 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 103 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 99.7Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 34.7Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 39.4 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 150 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 116Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1170Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1320 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 2100 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 1810Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorononanoic acid (PFNA) | ng/L | 11.0Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorononanoic acid (PFNA) | ng/L | 12.9 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 3620 | 5 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 3330Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 97.6Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 125 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 44.6Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 46.5 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 273Q | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 541 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 5.50J | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 3.06J | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 13.0 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 178 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 148 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 62.5 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 162 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1530 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 3370 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorononanoic acid (PFNA) | ng/L | 40.1 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 13400 | 10 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 158 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 31.2 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 835 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 425 | 1 | NA |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 8.34J | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 32.4 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 48.6 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 10.9 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 21.8 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 206 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 363 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorononanoic acid (PFNA) | ng/L | 10.3 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 2020 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 29.2 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 10.1 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 101 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 52.7 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 8.18J | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 35.2 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 26.3 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 3.83J | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 10.9 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 80.7 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 70.3 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 59.5 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 407 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 12.0 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 7.72J | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 39.4 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 31.5 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 7.98J | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 40.0 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 44.5 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 7.80J | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 77.8 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 32.9 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 40.6 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 63.7 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 9.64J | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 8.65J | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 29.3 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 38.3 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 10.5 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 48.1 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 52.3 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 5.56J | 1 | NA |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 95.2 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 41.3 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 54.9 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 39.4 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 6.76J | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 11.4 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 35.8 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 49.4 | 1 | NA |
| 22201053307 | CMT-VRTB-01-7_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 11.6 | 1 | NA |
| 22201053307 | CMT-VRTB-01-7_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 2.43J | 1 | NA |
| 22201053307 | CMT-VRTB-01-7_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 2.51J | 1 | NA |
| 22201053307 | CMT-VRTB-01-7_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 5.79J | 1 | NA |
| 22201053307 | CMT-VRTB-01-7_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 2.61J | 1 | NA |

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22201053301 | CMT-VRTB-01-1_12172021 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 18.7 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 57.6 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 30.8 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 38.8 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 108 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1190 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 139 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorononanoic acid (PFNA) | ng/L | 16.1 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 4950 | 5 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 119 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 39.3 | 1 | NA |
| 22201053301 | CMT-VRTB-01-1_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 74.2 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 57.2 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 34.2 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 14.5 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 42.7 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 77.8 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 132 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1690 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 158 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorononanoic acid (PFNA) | ng/L | 58.0 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 19700 | 10 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 159 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 32.3 | 1 | NA |
| 22201053302 | CMT-VRTB-01-2_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 116 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 8.71J | 1 | NA |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 13.3 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 13.4 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 19.6 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 231 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 23.3 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorononanoic acid (PFNA) | ng/L | 13.9 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 2850 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 29.9 | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 9.97J | 1 | NA |
| 22201053303 | CMT-VRTB-01-3_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 22.9 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 8.03J | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 35.8 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 4.83J | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 20.2 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 90.9 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 28.6 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorononanoic acid (PFNA) | ng/L | 4.29J | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 578 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 15.8 | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 7.14J | 1 | NA |
| 22201053304 | CMT-VRTB-01-4_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 62.4 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 7.70J | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 8.06J | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 3.94J | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 8.97J | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 95.4 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 13.7 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 102 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 12.5 | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 9.21J | 1 | NA |
| 22201053305 | CMT-VRTB-01-5_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 12.9 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 9.45J | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorobutanoic acid (PFBA) | ng/L | 8.74J | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 3.29J | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluoroheptanoic acid (PFHpA) | ng/L | 6.73J | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 122 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorohexanoic acid (PFHxA) | ng/L | 15.7 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 59.1 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluorooctanoic acid (PFOA) | ng/L | 9.02J | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 10.9 | 1 | NA |
| 22201053306 | CMT-VRTB-01-6_12172021 | Perfluoropentanoic acid (PFPeA) | ng/L | 11.0 | 1 | NA |
| 22201053307 | CMT-VRTB-01-7_12172021 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 13.1 | 1 | NA |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22201053307 | CMT-VRTB-01-7_12172021 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 7.31J | 1 | NA |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01-1_12172021** | **Collect Date** | 12/17/2021 15:13 | **Lab ID** | 22201053301 |
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/11/22 13:00 | 731392 | PFAS Top Assay QSM B15 (Pre) | 1 | 01/12/22 22:42 | 731514 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **18.7** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **57.6** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **30.8** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **38.8** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **108** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1190** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **139** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **16.1** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **119** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **39.3** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **74.2** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 457 | ng/L | 91 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 242 | ng/L | 97 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 269 | ng/L | 107 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 301 | ng/L | 121 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 293 | ng/L | 117 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 307 | ng/L | 123 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 259 | ng/L | 103 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 269 | ng/L | 108 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 274 | ng/L | 110 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 257 | ng/L | 103 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 259 | ng/L | 104 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 257 | ng/L | 103 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 274 | ng/L | 110 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 269 | ng/L | 108 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 249 | ng/L | 100 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 244 | ng/L | 97 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 264 | ng/L | 106 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01-1_12172021** | **Collect Date** | 12/17/2021 15:13 | **Lab ID** | 22201053301 |
|---|---|---|---|---|
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

*Results And limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/11/22 13:00 | 731392 | PFAS Top Assay QSM B15 (Pre) | 5 | 01/13/22 12:48 | 731571 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **4950** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 82.4 | ng/L | 82 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 235 | ng/L | 94 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01-1_12172021** | **Collect Date** | 12/17/2021 15:13 | **Lab ID** | 22201053301 |
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/12/22 11:50 | 731466 | PFAS Top Assay QSM B15 (Post) | 1 | 01/13/22 14:20 | 731571 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00UQ | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50UQ | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **23.2Q** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **4.40JQ** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00UQ | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00UQ | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0UQ | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0UQ | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5UQ | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **52.5Q** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **99.7Q** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50UQ | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50UQ | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50UQ | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **34.7Q** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **116Q** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1170Q** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **1810Q** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75UQ | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **11.0Q** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00UQ | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **3330Q** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **97.6Q** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **44.6Q** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **273Q** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50UQ | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50UQ | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50UQ | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 372 | ng/L | 74 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 274 | ng/L | 110 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 256 | ng/L | 103 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 260 | ng/L | 104 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 288 | ng/L | 115 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 269 | ng/L | 108 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 268 | ng/L | 107 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 247 | ng/L | 99 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 265 | ng/L | 106 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 278 | ng/L | 111 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 277 | ng/L | 111 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 249 | ng/L | 100 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 270 | ng/L | 108 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 242 | ng/L | 97 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 235 | ng/L | 94 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 275 | ng/L | 110 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01-1_12172021** | **Collect Date** | 12/17/2021 15:13 | **Lab ID** | 22201053301 |
|---|---|---|---|---|
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/19/22 18:14 | 731958 | PFAS Top Assay QSM B15 (Post) | 1 | 01/20/22 14:05 | 732043 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **63.2** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **103** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **39.4** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **150** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1320** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **2100** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **12.9** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **125** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **46.5** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **541** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 387 | ng/L | 77 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 207 | ng/L | 83 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 228 | ng/L | 91 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 210 | ng/L | 84 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 222 | ng/L | 89 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 261 | ng/L | 104 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 209 | ng/L | 84 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 195 | ng/L | 78 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 221 | ng/L | 89 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 209 | ng/L | 84 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 219 | ng/L | 88 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 198 | ng/L | 79 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 210 | ng/L | 84 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 228 | ng/L | 91 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 229 | ng/L | 92 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 204 | ng/L | 82 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 221 | ng/L | 88 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 200 | ng/L | 80 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 211 | ng/L | 85 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 153 | ng/L | 61 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 214 | ng/L | 86 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01-1_12172021** | **Collect Date** | 12/17/2021 15:13 | **Lab ID** | 22201053301 |
|---|---|---|---|---|
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

*Results And limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/19/22 18:14 | 731958 | PFAS Top Assay QSM B15 (Post) | 5 | 01/20/22 13:51 | 732043 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **3620** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 78.4 | ng/L | 78 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 223 | ng/L | 89 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01-2_12172021** | **Collect Date** | 12/17/2021 14:00 | **Lab ID** | 22201053302 |
|---|---|---|---|---|
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/11/22 13:00 | 731392 | PFAS Top Assay QSM B15 (Pre) | 1 | 01/12/22 22:56 | 731514 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **57.2** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **34.2** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **14.5** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **42.7** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **77.8** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **132** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1690** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **158** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **58.0** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **159** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **32.3** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **116** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 418 | ng/L | 84 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 266 | ng/L | 106 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 291 | ng/L | 117 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 269 | ng/L | 107 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 289 | ng/L | 116 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 261 | ng/L | 104 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 249 | ng/L | 100 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 267 | ng/L | 107 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 245 | ng/L | 98 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 237 | ng/L | 95 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 235 | ng/L | 94 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 231 | ng/L | 92 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 246 | ng/L | 98 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 176 | ng/L | 70 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 199 | ng/L | 80 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 232 | ng/L | 93 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 264 | ng/L | 105 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01-2_12172021** | **Collect Date** | 12/17/2021 14:00 | **Lab ID** | 22201053302 |
|---|---|---|---|---|
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

*Results And limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/11/22 13:00 | 731392 | PFAS Top Assay QSM B15 (Pre) | 10 | 01/13/22 13:03 | 731571 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **19700** | 19.0 | 50.0 | 100 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 50 | 38 | ng/L | 76 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 223 | ng/L | 89 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01-2_12172021** | **Collect Date** | 12/17/2021 14:00 | **Lab ID** | 22201053302 |
|---|---|---|---|---|
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/12/22 11:50 | 731466 | PFAS Top Assay QSM B15 (Post) | 1 | 01/16/22 17:06 | 731745 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **5.50J** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **3.06J** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **13.0** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **148** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **62.5** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **162** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1530** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **3370** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **40.1** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **158** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **31.2** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **425** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 345 | ng/L | 69 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 272 | ng/L | 109 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 251 | ng/L | 100 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 257 | ng/L | 103 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 274 | ng/L | 110 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 265 | ng/L | 106 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 247 | ng/L | 99 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 244 | ng/L | 98 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 232 | ng/L | 93 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 251 | ng/L | 100 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 218 | ng/L | 87 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 229 | ng/L | 92 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 233 | ng/L | 93 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 174 | ng/L | 70 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 213 | ng/L | 85 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 107 | ng/L | **43*** | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 266 | ng/L | 106 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01-2_12172021** | **Collect Date** | 12/17/2021 14:00 | **Lab ID** | 22201053302 |
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

*Results And limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/12/22 11:50 | 731466 | PFAS Top Assay QSM B15 (Post) | 10 | 01/18/22 17:45 | 732036 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **13400** | 19.0 | 50.0 | 100 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 50 | 36.6 | ng/L | 73 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 257 | ng/L | 103 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01-2_12172021** | **Collect Date** | 12/17/2021 14:00 | **Lab ID** | 22201053302 |
|---|---|---|---|---|
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/19/22 18:14 | 731958 | PFAS Top Assay QSM B15 (Post) | 1 | 01/20/22 14:35 | 732043 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **178** | 3.80 | 8.75 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **835** | 2.20 | 5.00 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 440 | ng/L | 88 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 223 | ng/L | 89 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 182 | ng/L | 73 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01-3_12172021** | **Collect Date** | 12/17/2021 11:57 | **Lab ID** | 22201053303 |
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/11/22 13:00 | 731392 | PFAS Top Assay QSM B15 (Pre) | 1 | 01/12/22 23:11 | 731514 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **8.71J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **13.3** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **13.4** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **19.6** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **231** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **23.3** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **13.9** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **2850** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **29.9** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **9.97J** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **22.9** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 513 | ng/L | 103 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 276 | ng/L | 111 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 289 | ng/L | 115 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 290 | ng/L | 116 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 287 | ng/L | 115 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 321 | ng/L | 128 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 281 | ng/L | 113 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 302 | ng/L | 121 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 273 | ng/L | 109 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 270 | ng/L | 108 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 271 | ng/L | 109 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 289 | ng/L | 116 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 285 | ng/L | 114 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 265 | ng/L | 106 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 276 | ng/L | 111 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 256 | ng/L | 103 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 266 | ng/L | 107 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 278 | ng/L | 111 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01-3_12172021** | **Collect Date** | 12/17/2021 11:57 | **Lab ID** | 22201053303 |
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/12/22 11:50 | 731466 | PFAS Top Assay QSM B15 (Post) | 1 | 01/13/22 15:05 | 731571 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **8.34J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **48.6** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **10.9** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **21.8** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **206** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **363** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **10.3** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **2020** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **29.2** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **10.1** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **52.7** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 393 | ng/L | 79 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 251 | ng/L | 100 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 275 | ng/L | 110 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 263 | ng/L | 105 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 282 | ng/L | 113 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 299 | ng/L | 120 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 282 | ng/L | 113 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 297 | ng/L | 119 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 276 | ng/L | 111 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 272 | ng/L | 109 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 281 | ng/L | 112 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 284 | ng/L | 113 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 282 | ng/L | 113 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 287 | ng/L | 115 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 283 | ng/L | 113 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 287 | ng/L | 115 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 252 | ng/L | 101 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 271 | ng/L | 108 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 279 | ng/L | 112 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01-3_12172021** | **Collect Date** | 12/17/2021 11:57 | **Lab ID** | 22201053303 |
|---|---|---|---|---|
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/19/22 18:14 | 731958 | PFAS Top Assay QSM B15 (Post) | 1 | 01/20/22 14:50 | 732043 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **32.4** | 3.80 | 8.75 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **101** | 2.20 | 5.00 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 352 | ng/L | 70 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 128 | ng/L | 51 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 42.6 | ng/L | **17*** | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01-4_12172021** | **Collect Date** | 12/17/2021 11:18 | **Lab ID** | 22201053304 |
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/11/22 13:00 | 731392 | PFAS Top Assay QSM B15 (Pre) | 1 | 01/12/22 23:26 | 731514 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **8.03J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **35.8** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **4.83J** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **20.2** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **90.9** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **28.6** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **4.29J** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **578** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **15.8** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **7.14J** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **62.4** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 477 | ng/L | 95 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 242 | ng/L | 97 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 272 | ng/L | 109 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 294 | ng/L | 118 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 281 | ng/L | 112 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 287 | ng/L | 115 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 262 | ng/L | 105 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 256 | ng/L | 103 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 266 | ng/L | 106 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 262 | ng/L | 105 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 248 | ng/L | 99 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 247 | ng/L | 99 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 244 | ng/L | 98 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 266 | ng/L | 106 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 227 | ng/L | 91 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 264 | ng/L | 106 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 236 | ng/L | 94 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 253 | ng/L | 101 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01-4_12172021** | **Collect Date** | 12/17/2021 11:18 | **Lab ID** | 22201053304 |
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/12/22 11:50 | 731466 | PFAS Top Assay QSM B15 (Post) | 1 | 01/13/22 15:20 | 731571 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **8.18J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **35.2** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **3.83J** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **10.9** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **80.7** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **59.5** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 5.00U | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **407** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **12.0** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **7.72J** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **31.5** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 399 | ng/L | 80 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 274 | ng/L | 110 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 288 | ng/L | 115 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 264 | ng/L | 106 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 263 | ng/L | 105 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 289 | ng/L | 116 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 276 | ng/L | 110 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 307 | ng/L | 123 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 274 | ng/L | 110 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 275 | ng/L | 110 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 285 | ng/L | 114 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 290 | ng/L | 116 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 282 | ng/L | 113 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 288 | ng/L | 115 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 285 | ng/L | 114 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 277 | ng/L | 111 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 292 | ng/L | 117 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 273 | ng/L | 109 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 283 | ng/L | 113 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 169 | ng/L | 67 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 281 | ng/L | 113 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01-4_12172021** | **Collect Date** | 12/17/2021 11:18 | **Lab ID** | 22201053304 |
|---|---|---|---|---|
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/24/22 18:07 | 732265 | PFAS Top Assay QSM B15 (Post) | 1 | 01/25/22 12:02 | 732329 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **26.3** | 3.80 | 8.75 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **70.3** | 2.35 | 5.00 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **39.4** | 2.20 | 5.00 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 401 | ng/L | 80 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 189 | ng/L | 76 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 154 | ng/L | 61 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 69.6 | ng/L | **28*** | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01-5_12172021** | **Collect Date** | 12/17/2021 14:16 | **Lab ID** | 22201053305 |
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/11/22 13:00 | 731392 | PFAS Top Assay QSM B15 (Pre) | 1 | 01/12/22 23:41 | 731514 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **7.70J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **8.06J** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **3.94J** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **8.97J** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **95.4** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **13.7** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 5.00U | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **102** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **12.5** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **9.21J** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **12.9** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 511 | ng/L | 102 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 259 | ng/L | 104 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 296 | ng/L | 118 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 294 | ng/L | 118 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 306 | ng/L | 122 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 297 | ng/L | 119 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 275 | ng/L | 110 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 294 | ng/L | 118 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 272 | ng/L | 109 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 274 | ng/L | 110 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 277 | ng/L | 111 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 275 | ng/L | 110 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 271 | ng/L | 108 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 286 | ng/L | 114 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 279 | ng/L | 111 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 262 | ng/L | 105 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 283 | ng/L | 113 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 282 | ng/L | 113 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 285 | ng/L | 114 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 270 | ng/L | 108 | 50 - 150 |

# Sample Results

| CMT-VRTB-01-5_12172021 | | | | |
|---|---|---|---|---|
| | Collect Date | 12/17/2021 14:16 | Lab ID | 22201053305 |
| | Receive Date | 01/05/2022 10:00 | Matrix | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/12/22 11:50 | 731466 | PFAS Top Assay QSM B15 (Post) | 1 | 01/13/22 15:35 | 731571 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **7.98J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **40.0** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **7.80J** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **77.8** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **32.9** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 5.00U | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **63.7** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **9.64J** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **8.65J** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **29.3** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 354 | ng/L | 71 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 230 | ng/L | 92 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 246 | ng/L | 98 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 244 | ng/L | 98 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 233 | ng/L | 93 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 264 | ng/L | 106 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 271 | ng/L | 108 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 254 | ng/L | 102 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 246 | ng/L | 99 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 259 | ng/L | 104 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 231 | ng/L | 92 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 250 | ng/L | 100 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 251 | ng/L | 101 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 250 | ng/L | 100 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 218 | ng/L | 87 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 262 | ng/L | 105 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01-5_12172021** | **Collect Date** | 12/17/2021 14:16 | **Lab ID** | 22201053305 |
|---|---|---|---|---|
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/24/22 18:07 | 732265 | PFAS Top Assay QSM B15 (Post) | 1 | 01/25/22 12:17 | 732329 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **44.5** | 3.80 | 8.75 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **40.6** | 2.35 | 5.00 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **38.3** | 2.20 | 5.00 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 436 | ng/L | 87 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 216 | ng/L | 86 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 216 | ng/L | 87 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 198 | ng/L | 79 | 50 - 150 |

# Sample Results

| CMT-VRTB-01-6_12172021 | Collect Date | 12/17/2021 11:55 | Lab ID | 22201053306 |
|---|---|---|---|---|
| | Receive Date | 01/05/2022 10:00 | Matrix | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/11/22 13:00 | 731392 | PFAS Top Assay QSM B15 (Pre) | 1 | 01/12/22 23:56 | 731514 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **9.45J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **8.74J** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **3.29J** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **6.73J** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **122** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **15.7** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 5.00U | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **59.1** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **9.02J** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **10.9** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **11.0** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 496 | ng/L | 99 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 286 | ng/L | 114 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 281 | ng/L | 112 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 286 | ng/L | 114 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 297 | ng/L | 119 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 277 | ng/L | 111 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 291 | ng/L | 116 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 274 | ng/L | 110 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 272 | ng/L | 109 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 280 | ng/L | 112 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 284 | ng/L | 114 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 282 | ng/L | 113 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 283 | ng/L | 113 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 280 | ng/L | 112 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 285 | ng/L | 114 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 271 | ng/L | 108 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01-6_12172021** | **Collect Date** | 12/17/2021 11:55 | **Lab ID** | 22201053306 |
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/12/22 11:50 | 731466 | PFAS Top Assay QSM B15 (Post) | 1 | 01/13/22 16:04 | 731571 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **10.5** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **52.3** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **5.56J** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **95.2** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **41.3** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 5.00U | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **39.4** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **6.76J** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **11.4** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **35.8** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 345 | ng/L | 69 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 288 | ng/L | 115 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 263 | ng/L | 105 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 259 | ng/L | 103 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 291 | ng/L | 116 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 280 | ng/L | 112 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 303 | ng/L | 121 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 277 | ng/L | 111 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 270 | ng/L | 108 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 283 | ng/L | 113 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 290 | ng/L | 116 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 277 | ng/L | 111 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 290 | ng/L | 116 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 283 | ng/L | 113 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 265 | ng/L | 106 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 289 | ng/L | 115 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 276 | ng/L | 110 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 283 | ng/L | 113 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 116 | ng/L | **47*** | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 283 | ng/L | 113 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01-6_12172021** | **Collect Date** | 12/17/2021 11:55 | **Lab ID** | 22201053306 |
|---|---|---|---|---|
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/24/22 18:07 | 732265 | PFAS Top Assay QSM B15 (Post) | 1 | 01/25/22 12:32 | 732329 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **48.1** | 3.80 | 8.75 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **54.9** | 2.35 | 5.00 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **49.4** | 2.20 | 5.00 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 414 | ng/L | 83 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 210 | ng/L | 84 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 212 | ng/L | 85 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 126 | ng/L | 50 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01-7_12172021** | **Collect Date** | 12/17/2021 11:10 | **Lab ID** | 22201053307 |
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/11/22 13:00 | 731392 | PFAS Top Assay QSM B15 (Pre) | 1 | 01/13/22 00:11 | 731514 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 5.00U | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 8.75U | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 7.50U | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **13.1** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 5.00U | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 5.00U | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **7.31J** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 5.00U | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 7.50U | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 5.00U | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 459 | ng/L | 92 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 282 | ng/L | 113 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 298 | ng/L | 119 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 292 | ng/L | 117 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 296 | ng/L | 119 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 281 | ng/L | 112 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 285 | ng/L | 114 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 278 | ng/L | 111 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 280 | ng/L | 112 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 264 | ng/L | 106 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 283 | ng/L | 113 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 281 | ng/L | 112 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 277 | ng/L | 111 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 287 | ng/L | 115 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 273 | ng/L | 109 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01-7_12172021** | **Collect Date** | 12/17/2021 11:10 | **Lab ID** | 22201053307 |
| | **Receive Date** | 01/05/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/12/22 11:50 | 731466 | PFAS Top Assay QSM B15 (Post) | 1 | 01/13/22 16:20 | 731571 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 16.7 | 37.5 | 50.0 | ng/L |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 5.00U | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 8.75U | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 7.50U | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **11.6** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **2.43J** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 5.00U | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **5.79J** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 5.00U | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 7.50U | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 5.00U | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 384 | ng/L | 77 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 281 | ng/L | 113 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 262 | ng/L | 105 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 274 | ng/L | 110 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 290 | ng/L | 116 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 289 | ng/L | 116 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 300 | ng/L | 120 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 275 | ng/L | 110 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 275 | ng/L | 110 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 272 | ng/L | 109 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 280 | ng/L | 112 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 276 | ng/L | 110 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 284 | ng/L | 114 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 283 | ng/L | 113 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 278 | ng/L | 111 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 277 | ng/L | 111 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 278 | ng/L | 111 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 201 | ng/L | 80 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 279 | ng/L | 111 | 50 - 150 |

# Sample Results

| CMT-VRTB-01-7_12172021 | Collect Date | 12/17/2021 11:10 | Lab ID | 22201053307 |
|---|---|---|---|---|
| | Receive Date | 01/05/2022 10:00 | Matrix | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 01/24/22 18:07 | 732265 | PFAS Top Assay QSM B15 (Post) | 1 | 01/25/22 12:46 | 732329 | SXA | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 8.75U | 3.80 | 8.75 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **2.51J** | 2.35 | 5.00 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **2.61J** | 2.20 | 5.00 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 419 | ng/L | 84 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 187 | ng/L | 75 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 150 | ng/L | 60 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 63.4 | ng/L | **25*** | 50 - 150 |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB731466 | LCS731466 | LCSD731466 |
|---|---|---|---|---|
| 731571 | Lab ID | 2295784 | 2295785 | 2295786 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 731466 | Prep Date | 01/12/22 11:50 | 01/12/22 11:50 | 01/12/22 11:50 |
| **Prep Method** | Analysis Date | 01/13/22 13:21 | 01/13/22 13:36 | 01/13/22 13:50 |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Post)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 763051-92-9 | 2.00U | 2.00 | 75.4 | 65.7 | 87 | 70 - 130 | 75.4 | 67.9 | 90 | 3 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 3.00U | 3.00 | 75.0 | 67.4 | 90 | 70 - 130 | 75.0 | 68.3 | 91 | 1 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 3.00U | 3.00 | 76.1 | 70.2 | 92 | 70 - 130 | 76.1 | 73.5 | 97 | 5 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 3.00U | 3.00 | 76.8 | 71.8 | 94 | 70 - 130 | 76.8 | 71.6 | 93 | 0 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 2.00U | 2.00 | 74.6 | 65.1 | 87 | 70 - 130 | 74.6 | 65.8 | 88 | 1 | 20 |
| ADONA | 919005-14-4 | 2.00U | 2.00 | 75.6 | 62.8 | 83 | 70 - 130 | 75.6 | 65.2 | 86 | 4 | 20 |
| NEtFOSAA | 2991-50-6 | 4.00U | 4.00 | 80.0 | 71.1 | 89 | 70 - 130 | 80.0 | 69.1 | 86 | 3 | 20 |
| NMeFOSAA | 2355-31-9 | 4.00U | 4.00 | 80.0 | 73.9 | 92 | 70 - 130 | 80.0 | 72.4 | 90 | 2 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 15.0U | 15.0 | 160 | 145 | 91 | 70 - 130 | 160 | 148 | 93 | 2 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 2.00U | 2.00 | 71.0 | 64.2 | 90 | 70 - 130 | 71.0 | 64.3 | 91 | 0 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 3.50U | 3.50 | 80.0 | 71.8 | 90 | 70 - 130 | 80.0 | 73.9 | 92 | 3 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 3.00U | 3.00 | 77.2 | 69.1 | 90 | 70 - 130 | 77.2 | 69.2 | 90 | 0 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 3.00U | 3.00 | 80.0 | 69.7 | 87 | 70 - 130 | 80.0 | 71.0 | 89 | 2 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 3.00U | 3.00 | 80.0 | 70.4 | 88 | 70 - 130 | 80.0 | 71.0 | 89 | 1 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 3.00U | 3.00 | 76.2 | 68.3 | 90 | 70 - 130 | 76.2 | 69.7 | 91 | 2 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 3.00U | 3.00 | 80.0 | 69.9 | 87 | 70 - 130 | 80.0 | 70.9 | 89 | 1 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 3.00U | 3.00 | 73.1 | 65.5 | 90 | 70 - 130 | 73.1 | 66.4 | 91 | 1 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 2.00U | 2.00 | 80.0 | 70.7 | 88 | 70 - 130 | 80.0 | 75.4 | 94 | 6 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 3.50U | 3.50 | 77.0 | 68.8 | 89 | 70 - 130 | 77.0 | 69.8 | 91 | 1 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 2.00U | 2.00 | 80.0 | 69.3 | 87 | 70 - 130 | 80.0 | 70.4 | 88 | 2 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 2.00U | 2.00 | 80.0 | 74.1 | 93 | 70 - 130 | 80.0 | 72.5 | 91 | 2 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 2.00U | 2.00 | 74.2 | 65.6 | 88 | 70 - 130 | 74.2 | 66.4 | 89 | 1 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 2.00U | 2.00 | 80.0 | 68.2 | 85 | 70 - 130 | 80.0 | 69.6 | 87 | 2 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 3.00U | 3.00 | 75.3 | 69.3 | 92 | 70 - 130 | 75.3 | 69.5 | 92 | 0 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 2.00U | 2.00 | 80.0 | 71.7 | 90 | 70 - 130 | 80.0 | 77.2 | 97 | 8 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 3.00U | 3.00 | 80.0 | 69.8 | 87 | 70 - 130 | 80.0 | 69.2 | 86 | 1 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 3.00U | 3.00 | 80.0 | 69.0 | 86 | 70 - 130 | 80.0 | 71.2 | 89 | 3 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 3.00U | 3.00 | 80.0 | 69.8 | 87 | 70 - 130 | 80.0 | 70.6 | 88 | 1 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 109 | 109 | 100 | 106 | 106 | 50 - 150 | 100 | 104 | 104 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 116 | 116 | 100 | 111 | 111 | 50 - 150 | 100 | 112 | 112 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 106 | 106 | 100 | 103 | 103 | 50 - 150 | 100 | 96.5 | 96 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 106 | 106 | 100 | 106 | 106 | 50 - 150 | 100 | 97.6 | 98 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 128 | 128 | 100 | 112 | 112 | 50 - 150 | 100 | 110 | 110 | NA | NA |
| M2PFTA | 376-06-7-EIS | 110 | 110 | 100 | 112 | 112 | 50 - 150 | 100 | 111 | 111 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 108 | 108 | 100 | 109 | 109 | 50 - 150 | 100 | 109 | 109 | NA | NA |
| M3PFBS | 375-73-5-EIS | 109 | 109 | 100 | 108 | 108 | 50 - 150 | 100 | 105 | 105 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 111 | 111 | 100 | 111 | 111 | 50 - 150 | 100 | 107 | 107 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 110 | 110 | 100 | 111 | 111 | 50 - 150 | 100 | 109 | 109 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 109 | 109 | 100 | 112 | 112 | 50 - 150 | 100 | 111 | 111 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 106 | 106 | 100 | 108 | 108 | 50 - 150 | 100 | 108 | 108 | NA | NA |
| M6PFDA | 335-76-2-EIS | 115 | 115 | 100 | 116 | 116 | 50 - 150 | 100 | 111 | 111 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 113 | 113 | 100 | 115 | 115 | 50 - 150 | 100 | 110 | 110 | NA | NA |
| M8FOSA | 754-91-6-EIS | 97.7 | 98 | 100 | 99.2 | 99 | 50 - 150 | 100 | 101 | 101 | NA | NA |
| M8PFOA | 335-67-1-EIS | 112 | 112 | 100 | 114 | 114 | 50 - 150 | 100 | 110 | 110 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 113 | 113 | 100 | 113 | 113 | 50 - 150 | 100 | 108 | 108 | NA | NA |
| M9PFNA | 375-95-1-EIS | 114 | 114 | 100 | 115 | 115 | 50 - 150 | 100 | 111 | 111 | NA | NA |
| MPFBA | 375-22-4-EIS | 106 | 106 | 100 | 107 | 107 | 50 - 150 | 100 | 107 | 107 | NA | NA |
| MPFDoA | 307-55-1-EIS | 114 | 114 | 100 | 113 | 113 | 50 - 150 | 100 | 111 | 111 | NA | NA |
| MPFOA | 335-67-1-SUR | 187 | 93 | 200 | 187 | 93 | 50 - 150 | 200 | 190 | 95 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB731958 | LCS731958 | LCSD731958 |
|---|---|---|---|---|
| 732043 | Lab ID | 2298934 | 2298935 | 2298936 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 731958 | Prep Date | 01/19/22 18:14 | 01/19/22 18:14 | 01/19/22 18:14 |
| **Prep Method** | Analysis Date | 01/20/22 13:06 | 01/20/22 13:21 | 01/20/22 13:36 |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Post)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 763051-92-9 | 2.00U | 2.00 | 75.4 | 67.1 | 89 | 70 - 130 | 75.4 | 74.1 | 98 | 10 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 3.00U | 3.00 | 75.0 | 67.6 | 90 | 70 - 130 | 75.0 | 74.2 | 99 | 9 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 3.00U | 3.00 | 76.1 | 70.4 | 93 | 70 - 130 | 76.1 | 78.2 | 103 | 10 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 3.00U | 3.00 | 76.8 | 74.0 | 96 | 70 - 130 | 76.8 | 76.7 | 100 | 4 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 2.00U | 2.00 | 74.6 | 67.8 | 91 | 70 - 130 | 74.6 | 74.0 | 99 | 9 | 20 |
| ADONA | 919005-14-4 | 2.00U | 2.00 | 75.6 | 71.2 | 94 | 70 - 130 | 75.6 | 75.0 | 99 | 5 | 20 |
| NEtFOSAA | 2991-50-6 | 4.00U | 4.00 | 80.0 | 78.9 | 99 | 70 - 130 | 80.0 | 86.6 | 108 | 9 | 20 |
| NMeFOSAA | 2355-31-9 | 4.00U | 4.00 | 80.0 | 79.3 | 99 | 70 - 130 | 80.0 | 84.0 | 105 | 6 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 15.0U | 15.0 | 160 | 157 | 98 | 70 - 130 | 160 | 170 | 106 | 8 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 2.00U | 2.00 | 71.0 | 66.4 | 94 | 70 - 130 | 71.0 | 71.9 | 101 | 8 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 3.50U | 3.50 | 80.0 | 75.1 | 94 | 70 - 130 | 80.0 | 79.9 | 100 | 6 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 3.00U | 3.00 | 77.2 | 71.9 | 93 | 70 - 130 | 77.2 | 76.7 | 99 | 6 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 3.00U | 3.00 | 80.0 | 75.8 | 95 | 70 - 130 | 80.0 | 80.0 | 100 | 5 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 3.00U | 3.00 | 80.0 | 76.5 | 96 | 70 - 130 | 80.0 | 81.6 | 102 | 6 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 3.00U | 3.00 | 76.2 | 71.8 | 94 | 70 - 130 | 76.2 | 78.4 | 103 | 9 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 3.00U | 3.00 | 80.0 | 73.5 | 92 | 70 - 130 | 80.0 | 79.2 | 99 | 8 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 3.00U | 3.00 | 73.1 | 66.6 | 91 | 70 - 130 | 73.1 | 72.4 | 99 | 8 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 2.00U | 2.00 | 80.0 | 75.3 | 94 | 70 - 130 | 80.0 | 80.1 | 100 | 6 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 3.50U | 3.50 | 77.0 | 72.1 | 94 | 70 - 130 | 77.0 | 79.3 | 103 | 9 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 2.00U | 2.00 | 80.0 | 76.4 | 95 | 70 - 130 | 80.0 | 80.7 | 101 | 6 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 2.00U | 2.00 | 80.0 | 78.2 | 98 | 70 - 130 | 80.0 | 83.8 | 105 | 7 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 2.00U | 2.00 | 74.2 | 67.8 | 91 | 70 - 130 | 74.2 | 73.0 | 98 | 7 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 2.00U | 2.00 | 80.0 | 75.3 | 94 | 70 - 130 | 80.0 | 79.8 | 100 | 6 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 3.00U | 3.00 | 75.3 | 70.0 | 93 | 70 - 130 | 75.3 | 75.1 | 100 | 7 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 2.00U | 2.00 | 80.0 | 74.4 | 93 | 70 - 130 | 80.0 | 79.8 | 100 | 7 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 3.00U | 3.00 | 80.0 | 73.3 | 92 | 70 - 130 | 80.0 | 80.4 | 100 | 9 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 3.00U | 3.00 | 80.0 | 75.7 | 95 | 70 - 130 | 80.0 | 76.9 | 96 | 2 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 3.00U | 3.00 | 80.0 | 71.3 | 89 | 70 - 130 | 80.0 | 78.2 | 98 | 9 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 79 | 79 | 100 | 71.6 | 72 | 50 - 150 | 100 | 77.4 | 77 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 82.7 | 83 | 100 | 73.7 | 74 | 50 - 150 | 100 | 78.1 | 78 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 90.5 | 90 | 100 | 77.8 | 78 | 50 - 150 | 100 | 79.5 | 79 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 95.5 | 96 | 100 | 83.6 | 84 | 50 - 150 | 100 | 87.3 | 87 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 100 | 100 | 100 | 83.4 | 83 | 50 - 150 | 100 | 88.8 | 89 | NA | NA |
| M2PFTA | 376-06-7-EIS | 81.4 | 81 | 100 | 75.6 | 76 | 50 - 150 | 100 | 77.4 | 77 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 70.8 | 71 | 100 | 72.8 | 73 | 50 - 150 | 100 | 75.6 | 76 | NA | NA |
| M3PFBS | 375-73-5-EIS | 83.5 | 84 | 100 | 81.3 | 81 | 50 - 150 | 100 | 84 | 84 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 84.4 | 84 | 100 | 83.6 | 84 | 50 - 150 | 100 | 86 | 86 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 83.7 | 84 | 100 | 82.9 | 83 | 50 - 150 | 100 | 85.5 | 85 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 80.4 | 80 | 100 | 79.7 | 80 | 50 - 150 | 100 | 81.5 | 82 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 83.3 | 83 | 100 | 82.3 | 82 | 50 - 150 | 100 | 83.7 | 84 | NA | NA |
| M6PFDA | 335-76-2-EIS | 86.4 | 86 | 100 | 81.2 | 81 | 50 - 150 | 100 | 85.6 | 86 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 85.7 | 86 | 100 | 82.5 | 83 | 50 - 150 | 100 | 87.2 | 87 | NA | NA |
| M8FOSA | 754-91-6-EIS | 82.8 | 83 | 100 | 77.5 | 78 | 50 - 150 | 100 | 77.7 | 78 | NA | NA |
| M8PFOA | 335-67-1-EIS | 84.3 | 84 | 100 | 81.2 | 81 | 50 - 150 | 100 | 85 | 85 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 86.3 | 86 | 100 | 81.4 | 81 | 50 - 150 | 100 | 85.3 | 85 | NA | NA |
| M9PFNA | 375-95-1-EIS | 84.7 | 85 | 100 | 79.8 | 80 | 50 - 150 | 100 | 83.7 | 84 | NA | NA |
| MPFBA | 375-22-4-EIS | 79.8 | 80 | 100 | 79.7 | 80 | 50 - 150 | 100 | 81.3 | 81 | NA | NA |
| MPFDoA | 307-55-1-EIS | 84.7 | 85 | 100 | 74.6 | 75 | 50 - 150 | 100 | 80.1 | 80 | NA | NA |
| MPFOA | 335-67-1-SUR | 175 | 88 | 200 | 165 | 82 | 50 - 150 | 200 | 181 | 90 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB732265 | LCS732265 | LCSD732265 |
|---|---|---|---|---|
| 732329 | Lab ID | 2300518 | 2300519 | 2300520 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 732265 | Prep Date | 01/24/22 18:07 | 01/24/22 18:07 | 01/24/22 18:07 |
| **Prep Method** | Analysis Date | 01/25/22 11:17 | 01/25/22 11:32 | 01/25/22 11:47 |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Post)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 3.50U | 3.50 | 80.0 | 77.9 | 97 | 70 - 130 | 80.0 | 77.0 | 96 | 1 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 2.00U | 2.00 | 80.0 | 75.5 | 94 | 70 - 130 | 80.0 | 75.8 | 95 | 1 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 2.00U | 2.00 | 80.0 | 78.1 | 98 | 70 - 130 | 80.0 | 76.5 | 96 | 2 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| M5PFHxA | 307-24-4-EIS | 84.1 | 84 | 100 | 83.9 | 84 | 50 - 150 | 100 | 83 | 83 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 85.1 | 85 | 100 | 83.9 | 84 | 50 - 150 | 100 | 83.5 | 83 | NA | NA |
| MPFBA | 375-22-4-EIS | 83.6 | 84 | 100 | 83.1 | 83 | 50 - 150 | 100 | 81.8 | 82 | NA | NA |
| MPFOA | 335-67-1-SUR | 178 | 89 | 200 | 174 | 87 | 50 - 150 | 200 | 177 | 89 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB731392 | LCS731392 | LCSD731392 |
|---|---|---|---|---|
| 731514 | Lab ID | 2295459 | 2295460 | 2295461 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 731392 | Prep Date | 01/11/22 13:00 | 01/11/22 13:00 | 01/11/22 13:00 |
| **Prep Method** | Analysis Date | 01/12/22 21:57 | 01/12/22 22:12 | 01/12/22 22:27 |
| PFAS Top Assay QSM B15 (Pre) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Pre)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 763051-92-9 | 2.00U | 2.00 | 75.4 | 69.0 | 91 | 70 - 130 | 75.4 | 69.7 | 92 | 1 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 3.00U | 3.00 | 75.0 | 71.6 | 95 | 70 - 130 | 75.0 | 73.9 | 99 | 3 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 3.00U | 3.00 | 76.1 | 76.2 | 100 | 70 - 130 | 76.1 | 75.1 | 99 | 1 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 3.00U | 3.00 | 76.8 | 76.8 | 100 | 70 - 130 | 76.8 | 76.4 | 99 | 1 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 2.00U | 2.00 | 74.6 | 68.1 | 91 | 70 - 130 | 74.6 | 69.2 | 93 | 2 | 20 |
| ADONA | 919005-14-4 | 2.00U | 2.00 | 75.6 | 65.7 | 87 | 70 - 130 | 75.6 | 67.3 | 89 | 2 | 20 |
| NEtFOSAA | 2991-50-6 | 4.00U | 4.00 | 80.0 | 71.9 | 90 | 70 - 130 | 80.0 | 70.8 | 88 | 2 | 20 |
| NMeFOSAA | 2355-31-9 | 4.00U | 4.00 | 80.0 | 75.8 | 95 | 70 - 130 | 80.0 | 76.4 | 95 | 1 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 15.0U | 15.0 | 160 | 152 | 95 | 70 - 130 | 160 | 154 | 96 | 1 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 2.00U | 2.00 | 71.0 | 65.4 | 92 | 70 - 130 | 71.0 | 65.6 | 92 | 0 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 3.50U | 3.50 | 80.0 | 74.7 | 93 | 70 - 130 | 80.0 | 75.1 | 94 | 1 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 3.00U | 3.00 | 77.2 | 70.2 | 91 | 70 - 130 | 77.2 | 72.6 | 94 | 3 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 3.00U | 3.00 | 80.0 | 72.3 | 90 | 70 - 130 | 80.0 | 73.6 | 92 | 2 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 3.00U | 3.00 | 80.0 | 73.9 | 92 | 70 - 130 | 80.0 | 72.2 | 90 | 2 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 3.00U | 3.00 | 76.2 | 70.4 | 92 | 70 - 130 | 76.2 | 70.9 | 93 | 1 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 3.00U | 3.00 | 80.0 | 71.7 | 90 | 70 - 130 | 80.0 | 72.1 | 90 | 1 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 3.00U | 3.00 | 73.1 | 67.2 | 92 | 70 - 130 | 73.1 | 67.5 | 92 | 1 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 2.00U | 2.00 | 80.0 | 73.8 | 92 | 70 - 130 | 80.0 | 73.4 | 92 | 1 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 3.50U | 3.50 | 77.0 | 71.3 | 93 | 70 - 130 | 77.0 | 71.7 | 93 | 1 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 2.00U | 2.00 | 80.0 | 71.8 | 90 | 70 - 130 | 80.0 | 74.3 | 93 | 3 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 2.00U | 2.00 | 80.0 | 76.0 | 95 | 70 - 130 | 80.0 | 75.1 | 94 | 1 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 2.00U | 2.00 | 74.2 | 67.9 | 91 | 70 - 130 | 74.2 | 69.0 | 93 | 2 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 2.00U | 2.00 | 80.0 | 71.3 | 89 | 70 - 130 | 80.0 | 72.5 | 91 | 2 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 3.00U | 3.00 | 75.3 | 69.9 | 93 | 70 - 130 | 75.3 | 70.9 | 94 | 1 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 2.00U | 2.00 | 80.0 | 74.1 | 93 | 70 - 130 | 80.0 | 74.3 | 93 | 0 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 3.00U | 3.00 | 80.0 | 72.5 | 91 | 70 - 130 | 80.0 | 71.3 | 89 | 2 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 3.00U | 3.00 | 80.0 | 74.0 | 92 | 70 - 130 | 80.0 | 72.5 | 91 | 2 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 3.00U | 3.00 | 80.0 | 72.2 | 90 | 70 - 130 | 80.0 | 72.1 | 90 | 0 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 102 | 102 | 100 | 108 | 108 | 50 - 150 | 100 | 107 | 107 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 116 | 116 | 100 | 114 | 114 | 50 - 150 | 100 | 116 | 116 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 106 | 106 | 100 | 111 | 111 | 50 - 150 | 100 | 107 | 107 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 110 | 110 | 100 | 110 | 110 | 50 - 150 | 100 | 112 | 112 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 121 | 121 | 100 | 113 | 113 | 50 - 150 | 100 | 112 | 112 | NA | NA |
| M2PFTA | 376-06-7-EIS | 109 | 109 | 100 | 114 | 114 | 50 - 150 | 100 | 113 | 113 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 110 | 110 | 100 | 114 | 114 | 50 - 150 | 100 | 115 | 115 | NA | NA |
| M3PFBS | 375-73-5-EIS | 102 | 102 | 100 | 109 | 109 | 50 - 150 | 100 | 109 | 109 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 105 | 105 | 100 | 111 | 111 | 50 - 150 | 100 | 109 | 109 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 106 | 106 | 100 | 111 | 111 | 50 - 150 | 100 | 111 | 111 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 103 | 103 | 100 | 110 | 110 | 50 - 150 | 100 | 113 | 113 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 103 | 103 | 100 | 107 | 107 | 50 - 150 | 100 | 109 | 109 | NA | NA |
| M6PFDA | 335-76-2-EIS | 112 | 112 | 100 | 115 | 115 | 50 - 150 | 100 | 115 | 115 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 112 | 112 | 100 | 114 | 114 | 50 - 150 | 100 | 111 | 111 | NA | NA |
| M8FOSA | 754-91-6-EIS | 95.8 | 96 | 100 | 96.8 | 97 | 50 - 150 | 100 | 102 | 102 | NA | NA |
| M8PFOA | 335-67-1-EIS | 110 | 110 | 100 | 115 | 115 | 50 - 150 | 100 | 113 | 113 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 110 | 110 | 100 | 112 | 112 | 50 - 150 | 100 | 110 | 110 | NA | NA |
| M9PFNA | 375-95-1-EIS | 110 | 110 | 100 | 115 | 115 | 50 - 150 | 100 | 112 | 112 | NA | NA |
| MPFBA | 375-22-4-EIS | 102 | 102 | 100 | 105 | 105 | 50 - 150 | 100 | 108 | 108 | NA | NA |
| MPFDoA | 307-55-1-EIS | 108 | 108 | 100 | 110 | 110 | 50 - 150 | 100 | 112 | 112 | NA | NA |
| MPFOA | 335-67-1-SUR | 197 | 99 | 200 | 204 | 102 | 50 - 150 | 200 | 208 | 104 | NA | NA |

# Top Assay Pre/Post Summary

| **Client ID** | CMT-VRTB-01-1_12172021 | | | | CMT-VRTB-01-2_12172021 | | | |
|---|---|---|---|---|---|---|---|---|
| **LAB ID** | 22201053301 | | | | 22201053302 | | | |
| **Collected** | 12/17/21 15:13 | | | | 12/17/21 14:00 | | | |
| **Matrix** | Water | | | | Water | | | |
| **Units** | ng/L | | | | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 18.7 | 7.50U | -18.7 | 200 | 57.2 | 5.50J | -51.7 | 164.9 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 7.50U | 0 | 0 | 34.2 | 3.06J | -31.14 | 167.1 |
| 9Cl-PF3ONS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| ADONA | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| NEtFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 37.5U | 0 | 0 | 37.5U | 37.5U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 57.6 | 52.5 | -5.1 | 9.3 | 14.5 | 13.0 | -1.5 | 10.9 |
| Perfluorobutanoic acid (PFBA) | 30.8 | 99.7 | 68.9 | 105.6 | 42.7 | 148 | 105.3 | 110.4 |
| Perfluorodecane sulfonic acid (PFDS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 38.8 | 34.7 | -4.1 | 11.2 | 77.8 | 62.5 | -15.3 | 21.8 |
| Perfluoroheptanoic acid (PFHpA) | 108 | 116 | 8 | 7.1 | 132 | 162 | 30 | 20.4 |
| Perfluorohexanesulfonic acid (PFHxS) | 1190 | 1170 | -20 | 1.7 | 1690 | 1530 | -160 | 9.9 |
| Perfluorohexanoic acid (PFHxA) | 139 | 1810 | 1671 | 171.5 | 158 | 3370 | 3212 | 182.1 |
| Perfluorononanesulfonic acid (PFNS) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 16.1 | 11.0 | -5.1 | 37.6 | 58.0 | 40.1 | -17.9 | 36.5 |
| Perfluorooctane Sulfonamide (FOSA) | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 4950 | 3330 | -1620 | 39.1 | 19700 | 13400 | -6300 | 38.1 |
| Perfluorooctanoic acid (PFOA) | 119 | 97.6 | -21.4 | 19.8 | 159 | 158 | -1 | 0.6 |
| Perfluoropentanesulfonic acid (PFPeS) | 39.3 | 44.6 | 5.3 | 12.6 | 32.3 | 31.2 | -1.1 | 3.5 |
| Perfluoropentanoic acid (PFPeA) | 74.2 | 273 | 198.8 | 114.5 | 116 | 425 | 309 | 114.2 |
| Perfluorotetradecanoic acid (PFTA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| **Client ID** | CMT-VRTB-01-3_12172021 | | | | CMT-VRTB-01-4_12172021 | | | |
|---|---|---|---|---|---|---|---|---|
| **LAB ID** | 22201053303 | | | | 22201053304 | | | |
| **Collected** | 12/17/21 11:57 | | | | 12/17/21 11:18 | | | |
| **Matrix** | Water | | | | Water | | | |
| **Units** | ng/L | | | | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 9Cl-PF3ONS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| ADONA | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| NEtFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 37.5U | 0 | 0 | 37.5U | 37.5U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 8.71J | 8.34J | -0.37 | 4.3 | 8.03J | 8.18J | 0.15 | 1.9 |
| Perfluorobutanoic acid (PFBA) | 13.3 | 32.4 | 19.1 | 83.6 | 35.8 | 26.3 | -9.5 | 30.6 |
| Perfluorodecane sulfonic acid (PFDS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 13.4 | 10.9 | -2.5 | 20.6 | 4.83J | 3.83J | -1 | 23.1 |
| Perfluoroheptanoic acid (PFHpA) | 19.6 | 21.8 | 2.2 | 10.6 | 20.2 | 10.9 | -9.3 | 59.8 |
| Perfluorohexanesulfonic acid (PFHxS) | 231 | 206 | -25 | 11.4 | 90.9 | 80.7 | -10.2 | 11.9 |
| Perfluorohexanoic acid (PFHxA) | 23.3 | 363 | 339.7 | 175.9 | 28.6 | 59.5 | 30.9 | 70.1 |
| Perfluorononanesulfonic acid (PFNS) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 13.9 | 10.3 | -3.6 | 29.8 | 4.29J | 5.00U | -4.29 | 200 |
| Perfluorooctane Sulfonamide (FOSA) | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 2850 | 2020 | -830 | 34.1 | 578 | 407 | -171 | 34.7 |
| Perfluorooctanoic acid (PFOA) | 29.9 | 29.2 | -0.7 | 2.4 | 15.8 | 12.0 | -3.8 | 27.3 |
| Perfluoropentanesulfonic acid (PFPeS) | 9.97J | 10.1 | 0.13 | 1.3 | 7.14J | 7.72J | 0.58 | 7.8 |
| Perfluoropentanoic acid (PFPeA) | 22.9 | 52.7 | 29.8 | 78.8 | 62.4 | 31.5 | -30.9 | 65.8 |
| Perfluorotetradecanoic acid (PFTA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| **Client ID** | CMT-VRTB-01-5_12172021 | | | | CMT-VRTB-01-6_12172021 | | | |
|---|---|---|---|---|---|---|---|---|
| **LAB ID** | 22201053305 | | | | 22201053306 | | | |
| **Collected** | 12/17/21 14:16 | | | | 12/17/21 11:55 | | | |
| **Matrix** | Water | | | | Water | | | |
| **Units** | ng/L | | | | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 9Cl-PF3ONS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| ADONA | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| NEtFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 37.5U | 0 | 0 | 37.5U | 37.5U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 7.70J | 7.98J | 0.28 | 3.6 | 9.45J | 10.5 | 1.05 | 10.5 |
| Perfluorobutanoic acid (PFBA) | 8.06J | 40.0 | 31.94 | 132.9 | 8.74J | 48.1 | 39.36 | 138.5 |
| Perfluorodecane sulfonic acid (PFDS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 3.94J | 7.50U | -3.94 | 200 | 3.29J | 7.50U | -3.29 | 200 |
| Perfluoroheptanoic acid (PFHpA) | 8.97J | 7.80J | -1.17 | 14 | 6.73J | 5.56J | -1.17 | 19 |
| Perfluorohexanesulfonic acid (PFHxS) | 95.4 | 77.8 | -17.6 | 20.3 | 122 | 95.2 | -26.8 | 24.7 |
| Perfluorohexanoic acid (PFHxA) | 13.7 | 32.9 | 19.2 | 82.4 | 15.7 | 41.3 | 25.6 | 89.8 |
| Perfluorononanesulfonic acid (PFNS) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| Perfluorooctane Sulfonamide (FOSA) | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 102 | 63.7 | -38.3 | 46.2 | 59.1 | 39.4 | -19.7 | 40 |
| Perfluorooctanoic acid (PFOA) | 12.5 | 9.64J | -2.86 | 25.8 | 9.02J | 6.76J | -2.26 | 28.6 |
| Perfluoropentanesulfonic acid (PFPeS) | 9.21J | 8.65J | -0.56 | 6.3 | 10.9 | 11.4 | 0.5 | 4.5 |
| Perfluoropentanoic acid (PFPeA) | 12.9 | 29.3 | 16.4 | 77.7 | 11.0 | 35.8 | 24.8 | 106 |
| Perfluorotetradecanoic acid (PFTA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| **Client ID** | CMT-VRTB-01-7_12172021 | | | |
|---|---|---|---|---|
| **LAB ID** | 22201053307 | | | |
| **Collected** | 12/17/21 11:10 | | | |
| **Matrix** | Water | | | |
| **Units** | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 5.00U | 5.00U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 7.50U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 7.50U | 0 | 0 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 7.50U | 0 | 0 |
| 9Cl-PF3ONS | 5.00U | 5.00U | 0 | 0 |
| ADONA | 5.00U | 5.00U | 0 | 0 |
| NEtFOSAA | 10.0U | 10.0U | 0 | 0 |
| NMeFOSAA | 10.0U | 10.0U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37.5U | 37.5U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 5.00U | 5.00U | 0 | 0 |
| Perfluorobutanoic acid (PFBA) | 8.75U | 8.75U | 0 | 0 |
| Perfluorodecane sulfonic acid (PFDS) | 7.50U | 7.50U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 7.50U | 7.50U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 7.50U | 7.50U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 7.50U | 7.50U | 0 | 0 |
| Perfluoroheptanoic acid (PFHpA) | 7.50U | 7.50U | 0 | 0 |
| Perfluorohexanesulfonic acid (PFHxS) | 13.1 | 11.6 | -1.5 | 12.1 |
| Perfluorohexanoic acid (PFHxA) | 5.00U | 2.43J | 2.43 | 200 |
| Perfluorononanesulfonic acid (PFNS) | 8.75U | 8.75U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 5.00U | 5.00U | 0 | 0 |
| Perfluorooctane Sulfonamide (FOSA) | 5.00U | 5.00U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 7.31J | 5.79J | -1.52 | 23.2 |
| Perfluorooctanoic acid (PFOA) | 5.00U | 5.00U | 0 | 0 |
| Perfluoropentanesulfonic acid (PFPeS) | 7.50U | 7.50U | 0 | 0 |
| Perfluoropentanoic acid (PFPeA) | 5.00U | 5.00U | 0 | 0 |
| Perfluorotetradecanoic acid (PFTA) | 7.50U | 7.50U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 7.50U | 7.50U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 7.50U | 7.50U | 0 | 0 |

Chain of Custody

Pace Analytical
www.pacelabs.com

Workorder: WL27010 Workorder Name: ESTCP Vertebrae Owner Received Date: 12/29/2021 Results Requested By: 1/10/2022

| Report To: | Subcontract To: |
|---|---|
| Kathy E. Smith | Project # |
| Pace Analytical | |
| 106 Vantage Point Drive | Pace Gulf Coast |
| Columbia SC, 29223 | 7979 Innovation Park Drive, |
| 803-227-2704 | Baton Rouge, LA 70820 |
| Kathy.Smith@pacelabs.com | |

| Item | Sample ID | Sample Type | Collect Date/Time | Lab ID | Matrix | Preserved Containers: UP | TOP Assay | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|
| 1 | CMT-VRTB-01-1_12172021 | grab | 12/17/2021 @ 1513 | WL27010-004 | Aqueous | X | X | 1 |
| 2 | CMT-VRTB-01-2_12172021 | grab | 12/17/2021 @ 1400 | WL27010-005 | Aqueous | X | X | 2 |
| 3 | CMT-VRTB-01-3_12172021 | grab | 12/17/2021 @ 1157 | WL27010-006 | Aqueous | X | X | 3 |
| 4 | CMT-VRTB-01-4_12172021 | grab | 12/17/2021 @ 1118 | WL27010-007 | Aqueous | X | X | 4 |
| 5 | CMT-VRTB-01-5_12172021 | grab | 12/17/2021 @ 1416 | WL27010-008 | Aqueous | X | X | 5 |
| 6 | CMT-VRTB-01-6_12172021 | grab | 12/17/2021 @ 1155 | WL27010-009 | Aqueous | X | X | 6 |
| 7 | CMT-VRTB-01-7_12172021 | grab | 12/17/2021 @ 1110 | WL27010-010 | Aqueous | X | X | 7 |
| 8 | | | | | | | | |
| 9 | **may have high levels of PFAS*** | | | | | | | |
| 10 | | | | | | | | |

| Transfers | Released By | Date/Time | Reveived By | Date/Time | Comments |
|---|---|---|---|---|---|
| 1 | | 1/4/22 1700 | | | 1.3E3(4 |
| 2 | FedEx | 1/5/22 10.00 | | 1/5/22 18.00 | 1663 3466 3081 |
| 3 | | | | | |

| Cooler Temperature on Receipt _____ °C | Custody Seal Y or N | Received on Ice Y or N | Sample Intact Y or N |
|---|---|---|---|

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document.
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Friday, June 17, 2016 11:01:34 AM FMT-ALL-C-002rev.00

Client ID: 4367 - Pace Analytical Services
SDG: 222010533
PM: RWe

# SAMPLE RECEIVING CHECKLIST

| SAMPLE DELIVERY GROUP 222010533 | |
|---|---|
| **Client** **PM** RWe<br>4367 - Pace Analytical Services | **Transport Method**<br>FEDEX |
| **Profile Number**<br>294268 | **Received By**<br>McCune, Dodie N. |
| **Line Item(s)**<br>4 - Top Assay Water | **Receive Date(s)**<br>01/05/22 |

| CHECKLIST | YES | NO |
|---|---|---|
| Samples received with proper thermal preservation? | ☑ | ☐ |
| Radioactivity is <1600 cpm? If no, record cpm value in notes section. | ☑ | ☐ |
| COC relinquished and complete (including sampleIDs, collect times, and sampler)? | ☑ | ☐ |
| All containers received in good condition and within hold time? | ☑ | ☐ |
| All sample labels and containers received match the chain of custody? | ☑ | ☐ |
| Preservative added to any containers? | ☐ | ☑ |
| If received, was headspace for VOC water containers < 6mm? | ☑ | ☐ |
| Samples collected in containers provided by Pace Gulf Coast? | ☑ | ☐ |

**COOLERS**

| Airbill | Thermometer ID: E34 | Temp °C |
|---|---|---|
| 166334663081 | | 1.3 |

**DISCREPANCIES**

None

**LAB PRESERVATIONS**

None

**NOTES**

Revision 1.6

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP Vertebrae

Project Number: 30027244.00002

Lot Number:**WL27010**

Date Completed:02/01/2022

02/03/2022 7:32 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: WL27010

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report. Where sampling is conducted by the client, results relate to the accuracy of the information provided, and as the samples are received.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: WL27010

Project Name: ESTCP Vertebrae

Project Number: 30027244.00002

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | Dup-01_12132021 | Aqueous | 12/13/2021 | 12/24/2021 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | 12/13/2021 1325 | 12/24/2021 |
| 003 | MW-VRTB-1D_12132021 | Aqueous | 12/13/2021 1215 | 12/24/2021 |
| 004 | CMT-VRTB-01-1_12172021 | Aqueous | 12/17/2021 1513 | 12/24/2021 |
| 005 | CMT-VRTB-01-2_12172021 | Aqueous | 12/17/2021 1400 | 12/24/2021 |
| 006 | CMT-VRTB-01-3_12172021 | Aqueous | 12/17/2021 1157 | 12/24/2021 |
| 007 | CMT-VRTB-01-4_12172021 | Aqueous | 12/17/2021 1118 | 12/24/2021 |
| 008 | CMT-VRTB-01-5_12172021 | Aqueous | 12/17/2021 1416 | 12/24/2021 |
| 009 | CMT-VRTB-01-6_12172021 | Aqueous | 12/17/2021 1155 | 12/24/2021 |
| 010 | CMT-VRTB-01-7_12172021 | Aqueous | 12/17/2021 1110 | 12/24/2021 |
| 011 | VRTB-S-O6_12132021 | Aqueous | 12/13/2021 1650 | 12/24/2021 |
| 012 | VRTB-S-M5_12152021 | Aqueous | 12/15/2021 1640 | 12/24/2021 |
| 013 | VRTB-D-S2_12152021 | Aqueous | 12/15/2021 1412 | 12/24/2021 |
| 014 | VRTB-D-G4_12152021 | Aqueous | 12/15/2021 1315 | 12/24/2021 |
| 015 | VRTB-D-Y3_12152021 | Aqueous | 12/15/2021 1508 | 12/24/2021 |
| 016 | VRTB-D-B1_12142021 | Aqueous | 12/14/2021 1710 | 12/24/2021 |

(16 samples)

# Detection Summary

## Arcadis U.S., Inc.

Lot Number: WL27010

Project Name: ESTCP Vertebrae

Project Number: 30027244.00002

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | Dup-01_12132021 | Aqueous | 8:2 FTS | PFAS by ID | 29 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | 6:2 FTS | PFAS by ID | 35 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | PFBS | PFAS by ID | 14 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | PFHpS | PFAS by ID | 55 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | PFPeS | PFAS by ID | 34 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | PFHxS | PFAS by ID | 1200 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | PFBA | PFAS by ID | 29 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | PFHpA | PFAS by ID | 73 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | PFHxA | PFAS by ID | 100 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | PFNA | PFAS by ID | 36 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | PFOA | PFAS by ID | 110 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | PFPeA | PFAS by ID | 76 | | ng/L | 7 |
| 001 | Dup-01_12132021 | Aqueous | PFOS | PFAS by ID | 16000 | | ng/L | 7 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | 8:2 FTS | PFAS by ID | 33 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | 6:2 FTS | PFAS by ID | 38 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | PFBS | PFAS by ID | 15 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | PFHpS | PFAS by ID | 55 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | PFPeS | PFAS by ID | 36 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | PFHxS | PFAS by ID | 1300 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | PFBA | PFAS by ID | 29 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | PFHpA | PFAS by ID | 74 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | PFHxA | PFAS by ID | 110 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | PFNA | PFAS by ID | 39 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | PFOA | PFAS by ID | 110 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | PFPeA | PFAS by ID | 78 | | ng/L | 9 |
| 002 | MW-VRTB-1S_12132021 | Aqueous | PFOS | PFAS by ID | 16000 | | ng/L | 9 |
| 003 | MW-VRTB-1D_12132021 | Aqueous | PFBS | PFAS by ID | 5.0 | | ng/L | 11 |
| 003 | MW-VRTB-1D_12132021 | Aqueous | PFHpS | PFAS by ID | 2.9 | J | ng/L | 11 |
| 003 | MW-VRTB-1D_12132021 | Aqueous | PFPeS | PFAS by ID | 7.0 | | ng/L | 11 |
| 003 | MW-VRTB-1D_12132021 | Aqueous | PFHxS | PFAS by ID | 85 | | ng/L | 11 |
| 003 | MW-VRTB-1D_12132021 | Aqueous | PFBA | PFAS by ID | 14 | | ng/L | 11 |
| 003 | MW-VRTB-1D_12132021 | Aqueous | PFHpA | PFAS by ID | 4.8 | | ng/L | 11 |
| 003 | MW-VRTB-1D_12132021 | Aqueous | PFHxA | PFAS by ID | 13 | | ng/L | 11 |
| 003 | MW-VRTB-1D_12132021 | Aqueous | PFOA | PFAS by ID | 6.7 | | ng/L | 11 |
| 003 | MW-VRTB-1D_12132021 | Aqueous | PFPeA | PFAS by ID | 9.5 | | ng/L | 11 |
| 003 | MW-VRTB-1D_12132021 | Aqueous | PFOS | PFAS by ID | 58 | | ng/L | 11 |
| 011 | VRTB-S-O6_12132021 | Aqueous | 8:2 FTS | PFAS by ID | 2.6 | J | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFBS | PFAS by ID | 9.7 | | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFHpS | PFAS by ID | 34 | | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFOSA | PFAS by ID | 3.4 | J | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFPeS | PFAS by ID | 20 | | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFHxS | PFAS by ID | 330 | | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFBA | PFAS by ID | 8.1 | | ng/L | 13 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 011 | VRTB-S-O6_12132021 | Aqueous | PFDA | PFAS by ID | 1.0 | J | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFHpA | PFAS by ID | 12 | | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFHxA | PFAS by ID | 26 | | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFNA | PFAS by ID | 7.4 | | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFOA | PFAS by ID | 33 | | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFPeA | PFAS by ID | 15 | | ng/L | 13 |
| 011 | VRTB-S-O6_12132021 | Aqueous | PFOS | PFAS by ID | 2000 | | ng/L | 13 |
| 012 | VRTB-S-M5_12152021 | Aqueous | 8:2 FTS | PFAS by ID | 3.7 | J | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | 6:2 FTS | PFAS by ID | 6.4 | J | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | PFBS | PFAS by ID | 3.3 | J | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | PFHpS | PFAS by ID | 13 | | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | PFPeS | PFAS by ID | 6.6 | | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | PFHxS | PFAS by ID | 150 | | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | PFBA | PFAS by ID | 9.1 | | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | PFHpA | PFAS by ID | 17 | | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | PFHxA | PFAS by ID | 24 | | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | PFNA | PFAS by ID | 7.6 | | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | PFOA | PFAS by ID | 25 | | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | PFPeA | PFAS by ID | 19 | | ng/L | 15 |
| 012 | VRTB-S-M5_12152021 | Aqueous | PFOS | PFAS by ID | 1100 | | ng/L | 15 |
| 013 | VRTB-D-S2_12152021 | Aqueous | PFBS | PFAS by ID | 9.0 | | ng/L | 17 |
| 013 | VRTB-D-S2_12152021 | Aqueous | PFHpS | PFAS by ID | 5.1 | | ng/L | 17 |
| 013 | VRTB-D-S2_12152021 | Aqueous | PFPeS | PFAS by ID | 13 | | ng/L | 17 |
| 013 | VRTB-D-S2_12152021 | Aqueous | PFHxS | PFAS by ID | 130 | | ng/L | 17 |
| 013 | VRTB-D-S2_12152021 | Aqueous | PFBA | PFAS by ID | 6.0 | | ng/L | 17 |
| 013 | VRTB-D-S2_12152021 | Aqueous | PFHpA | PFAS by ID | 6.6 | | ng/L | 17 |
| 013 | VRTB-D-S2_12152021 | Aqueous | PFHxA | PFAS by ID | 13 | | ng/L | 17 |
| 013 | VRTB-D-S2_12152021 | Aqueous | PFNA | PFAS by ID | 1.3 | J | ng/L | 17 |
| 013 | VRTB-D-S2_12152021 | Aqueous | PFOA | PFAS by ID | 25 | | ng/L | 17 |
| 013 | VRTB-D-S2_12152021 | Aqueous | PFPeA | PFAS by ID | 8.8 | | ng/L | 17 |
| 013 | VRTB-D-S2_12152021 | Aqueous | PFOS | PFAS by ID | 170 | | ng/L | 17 |
| 014 | VRTB-D-G4_12152021 | Aqueous | PFPeS | PFAS by ID | 1.4 | J | ng/L | 19 |
| 014 | VRTB-D-G4_12152021 | Aqueous | PFHxS | PFAS by ID | 45 | | ng/L | 19 |
| 014 | VRTB-D-G4_12152021 | Aqueous | PFBA | PFAS by ID | 6.9 | | ng/L | 19 |
| 014 | VRTB-D-G4_12152021 | Aqueous | PFHpA | PFAS by ID | 3.8 | J | ng/L | 19 |
| 014 | VRTB-D-G4_12152021 | Aqueous | PFHxA | PFAS by ID | 13 | | ng/L | 19 |
| 014 | VRTB-D-G4_12152021 | Aqueous | PFOA | PFAS by ID | 4.7 | | ng/L | 19 |
| 014 | VRTB-D-G4_12152021 | Aqueous | PFPeA | PFAS by ID | 20 | | ng/L | 19 |
| 014 | VRTB-D-G4_12152021 | Aqueous | PFOS | PFAS by ID | 110 | | ng/L | 19 |
| 015 | VRTB-D-Y3_12152021 | Aqueous | PFBS | PFAS by ID | 3.1 | J | ng/L | 21 |
| 015 | VRTB-D-Y3_12152021 | Aqueous | PFHpS | PFAS by ID | 2.1 | J | ng/L | 21 |
| 015 | VRTB-D-Y3_12152021 | Aqueous | PFPeS | PFAS by ID | 5.7 | | ng/L | 21 |
| 015 | VRTB-D-Y3_12152021 | Aqueous | PFHxS | PFAS by ID | 57 | | ng/L | 21 |
| 015 | VRTB-D-Y3_12152021 | Aqueous | PFBA | PFAS by ID | 4.1 | | ng/L | 21 |
| 015 | VRTB-D-Y3_12152021 | Aqueous | PFHpA | PFAS by ID | 3.7 | J | ng/L | 21 |
| 015 | VRTB-D-Y3_12152021 | Aqueous | PFHxA | PFAS by ID | 5.8 | | ng/L | 21 |
| 015 | VRTB-D-Y3_12152021 | Aqueous | PFOA | PFAS by ID | 8.4 | | ng/L | 21 |
| 015 | VRTB-D-Y3_12152021 | Aqueous | PFPeA | PFAS by ID | 3.8 | J | ng/L | 21 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 015 | VRTB-D-Y3_12152021 | Aqueous | PFOS | PFAS by ID | 100 | | ng/L | 21 |
| 016 | VRTB-D-B1_12142021 | Aqueous | 8:2 FTS | PFAS by ID | 3.0 | J | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | 6:2 FTS | PFAS by ID | 2.5 | J | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | PFBS | PFAS by ID | 13 | | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | PFHpS | PFAS by ID | 9.7 | | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | PFPeS | PFAS by ID | 14 | | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | PFHxS | PFAS by ID | 160 | | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | PFBA | PFAS by ID | 13 | | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | PFHpA | PFAS by ID | 12 | | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | PFHxA | PFAS by ID | 21 | | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | PFNA | PFAS by ID | 3.1 | J | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | PFOA | PFAS by ID | 22 | | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | PFPeA | PFAS by ID | 17 | | ng/L | 23 |
| 016 | VRTB-D-B1_12142021 | Aqueous | PFOS | PFAS by ID | 700 | | ng/L | 23 |

(105 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL27010-001
Description: Dup-01_12132021 | Matrix: Aqueous
Date Sampled: 12/13/2021 | Project Name: ESTCP Vertebrae
Date Received: 12/24/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/09/2022 2217 | JJG | 01/07/2022 1703 | 27771 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 50 | 01/11/2022 1909 | JJG | 01/07/2022 1703 | 27771 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 29 | | 7.7 | 3.9 | 1.9 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 35 | | 7.7 | 3.9 | 1.9 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.9 | U | 7.7 | 3.9 | 1.9 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.9 | U | 7.7 | 3.9 | 1.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.5 | U | 15 | 7.5 | 3.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.9 | U | 7.7 | 3.9 | 1.9 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 14 | | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 55 | | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 34 | | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1200 | | 190 | 95 | 48 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 29 | | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 73 | | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 100 | | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 36 | | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 110 | | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 76 | | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.96 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 16000 | | 190 | 95 | 48 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 | | 87 | 50-150 |
| 13C2_6:2FTS | | 105 | 50-150 | | 92 | 50-150 |
| 13C2_8:2FTS | | 126 | 50-150 | | 85 | 50-150 |
| 13C2_PFDoA | | 102 | 50-150 | | 101 | 50-150 |
| 13C2_PFTeDA | | 102 | 50-150 | | 96 | 50-150 |
| 13C3_PFBS | | 111 | 50-150 | | 103 | 50-150 |
| 13C3_PFHxS | | 105 | 50-150 | | 98 | 50-150 |
| 13C4_PFBA | | 105 | 50-150 | | 94 | 50-150 |
| 13C4_PFHpA | | 107 | 50-150 | | 99 | 50-150 |
| 13C5_PFHxA | | 108 | 50-150 | | 93 | 50-150 |
| 13C5_PFPeA | | 103 | 50-150 | | 95 | 50-150 |
| 13C6_PFDA | | 117 | 50-150 | | 93 | 50-150 |
| 13C7_PFUdA | | 114 | 50-150 | | 100 | 50-150 |
| 13C8_PFOA | | 109 | 50-150 | | 86 | 50-150 |
| 13C8_PFOS | | 76 | 50-150 | | 96 | 50-150 |
| 13C8_PFOSA | | 114 | 50-150 | | 93 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL27010-001 |
| Description: Dup-01_12132021 | | | Matrix: Aqueous |
| Date Sampled: 12/13/2021 | Project Name: ESTCP Vertebrae | | |
| Date Received: 12/24/2021 | Project Number: 30027244.00002 | | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 59 | 50-150 | | 93 | 50-150 |
| d5-EtFOSAA | | 116 | 50-150 | | 103 | 50-150 |
| d-MeFOSA | | 94 | 50-150 | | 93 | 50-150 |
| d3-MeFOSAA | | 118 | 50-150 | | 99 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL27010-002
Description: MW-VRTB-1S_12132021 | Matrix: Aqueous
Date Sampled: 12/13/2021 1325 | Project Name: ESTCP Vertebrae
Date Received: 12/24/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/09/2022 2228 | JJG | 01/07/2022 1703 | 27771 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 50 | 01/10/2022 1920 | JJG | 01/07/2022 1703 | 27771 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 33 | | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 38 | | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.8 | U | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.8 | U | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.5 | U | 15 | 7.5 | 3.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.8 | U | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 15 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 55 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 36 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1300 | | 190 | 95 | 47 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 29 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 74 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 110 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 39 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 110 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 78 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 16000 | | 190 | 95 | 47 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 | | 115 | 50-150 |
| 13C2_6:2FTS | | 103 | 50-150 | | 99 | 50-150 |
| 13C2_8:2FTS | | 118 | 50-150 | | 105 | 50-150 |
| 13C2_PFDoA | | 98 | 50-150 | | 109 | 50-150 |
| 13C2_PFTeDA | | 96 | 50-150 | | 100 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 | | 103 | 50-150 |
| 13C3_PFHxS | | 104 | 50-150 | | 101 | 50-150 |
| 13C4_PFBA | | 101 | 50-150 | | 108 | 50-150 |
| 13C4_PFHpA | | 100 | 50-150 | | 105 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 | | 104 | 50-150 |
| 13C5_PFPeA | | 101 | 50-150 | | 107 | 50-150 |
| 13C6_PFDA | | 111 | 50-150 | | 100 | 50-150 |
| 13C7_PFUdA | | 107 | 50-150 | | 104 | 50-150 |
| 13C8_PFOA | | 101 | 50-150 | | 107 | 50-150 |
| 13C8_PFOS | | 72 | 50-150 | | 103 | 50-150 |
| 13C8_PFOSA | | 115 | 50-150 | | 102 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WL27010-002
Description: MW-VRTB-1S_12132021
Matrix: Aqueous
Date Sampled: 12/13/2021 1325
Project Name: ESTCP Vertebrae
Date Received: 12/24/2021
Project Number: 30027244.00002

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 55 | 50-150 | | 103 | 50-150 |
| d5-EtFOSAA | | 113 | 50-150 | | 101 | 50-150 |
| d-MeFOSA | | 94 | 50-150 | | 103 | 50-150 |
| d3-MeFOSAA | | 111 | 50-150 | | 98 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL27010-003
Description: MW-VRTB-1D_12132021 | Matrix: Aqueous
Date Sampled: 12/13/2021 1215 | Project Name: ESTCP Vertebrae
Date Received: 12/24/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/09/2022 2239 | JJG | 01/07/2022 1703 | 27771 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 3.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 5.0 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.9 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 7.0 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 85 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 14 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 4.8 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 13 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 6.7 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 9.5 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 58 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 108 | 50-150 |
| 13C2_6:2FTS | | 122 | 50-150 |
| 13C2_8:2FTS | | 124 | 50-150 |
| 13C2_PFDoA | | 105 | 50-150 |
| 13C2_PFTeDA | | 111 | 50-150 |
| 13C3_PFBS | | 112 | 50-150 |
| 13C3_PFHxS | | 111 | 50-150 |
| 13C4_PFBA | | 108 | 50-150 |
| 13C4_PFHpA | | 118 | 50-150 |
| 13C5_PFHxA | | 109 | 50-150 |
| 13C5_PFPeA | | 110 | 50-150 |
| 13C6_PFDA | | 119 | 50-150 |
| 13C7_PFUdA | | 123 | 50-150 |
| 13C8_PFOA | | 119 | 50-150 |
| 13C8_PFOS | | 119 | 50-150 |
| 13C8_PFOSA | | 119 | 50-150 |
| 13C9_PFNA | | 103 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL27010-003 |
| Description: MW-VRTB-1D_12132021 | | | Matrix: Aqueous |
| Date Sampled: 12/13/2021 1215 | | Project Name: ESTCP Vertebrae | |
| Date Received: 12/24/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 121 | 50-150 |
| d-MeFOSA | | 99 | 50-150 |
| d3-MeFOSAA | | 121 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL27010-011
Description: VRTB-S-O6_12132021 | Matrix: Aqueous
Date Sampled: 12/13/2021 1650 | Project Name: ESTCP Vertebrae
Date Received: 12/24/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/09/2022 2312 | JJG | 01/07/2022 1703 | 27771 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 01/10/2022 1942 | JJG | 01/07/2022 1703 | 27771 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 2.6 | J | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.7 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 34 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 3.4 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 20 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 330 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 8.1 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.0 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 12 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 26 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.4 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 33 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 15 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2000 | | 40 | 20 | 10 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 98 | 50-150 | | 123 | 50-150 |
| 13C2_6:2FTS | | 111 | 50-150 | | 103 | 50-150 |
| 13C2_8:2FTS | | 122 | 50-150 | | 100 | 50-150 |
| 13C2_PFDoA | | 98 | 50-150 | | 107 | 50-150 |
| 13C2_PFTeDA | | 88 | 50-150 | | 101 | 50-150 |
| 13C3_PFBS | | 106 | 50-150 | | 105 | 50-150 |
| 13C3_PFHxS | | 109 | 50-150 | | 101 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 | | 109 | 50-150 |
| 13C4_PFHpA | | 110 | 50-150 | | 105 | 50-150 |
| 13C5_PFHxA | | 97 | 50-150 | | 106 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 | | 106 | 50-150 |
| 13C6_PFDA | | 114 | 50-150 | | 101 | 50-150 |
| 13C7_PFUdA | | 108 | 50-150 | | 106 | 50-150 |
| 13C8_PFOA | | 105 | 50-150 | | 107 | 50-150 |
| 13C8_PFOS | | 98 | 50-150 | | 108 | 50-150 |
| 13C8_PFOSA | | 114 | 50-150 | | 103 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WL27010-011
Description: VRTB-S-O6_12132021
Matrix: Aqueous
Date Sampled: 12/13/2021 1650
Project Name: ESTCP Vertebrae
Date Received: 12/24/2021
Project Number: 30027244.00002

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 82 | 50-150 | | 105 | 50-150 |
| d5-EtFOSAA | | 117 | 50-150 | | 98 | 50-150 |
| d-MeFOSA | | 93 | 50-150 | | 98 | 50-150 |
| d3-MeFOSAA | | 116 | 50-150 | | 99 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL27010-012
Description: VRTB-S-M5_12152021 | Matrix: Aqueous
Date Sampled: 12/15/2021 1640 | Project Name: ESTCP Vertebrae
Date Received: 12/24/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/09/2022 2323 | JJG | 01/07/2022 1703 | 27771 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 01/10/2022 1953 | JJG | 01/07/2022 1703 | 27771 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.7 | J | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 6.4 | J | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 3.3 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 13 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 6.6 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 150 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 9.1 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 17 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 24 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.6 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 25 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 19 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1100 | | 20 | 10 | 4.9 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 99 | 50-150 | | 143 | 50-150 |
| 13C2_6:2FTS | | 117 | 50-150 | | 104 | 50-150 |
| 13C2_8:2FTS | | 123 | 50-150 | | 110 | 50-150 |
| 13C2_PFDoA | | 95 | 50-150 | | 116 | 50-150 |
| 13C2_PFTeDA | | 60 | 50-150 | | 100 | 50-150 |
| 13C3_PFBS | | 105 | 50-150 | | 110 | 50-150 |
| 13C3_PFHxS | | 112 | 50-150 | | 111 | 50-150 |
| 13C4_PFBA | | 104 | 50-150 | | 119 | 50-150 |
| 13C4_PFHpA | | 109 | 50-150 | | 116 | 50-150 |
| 13C5_PFHxA | | 102 | 50-150 | | 114 | 50-150 |
| 13C5_PFPeA | | 101 | 50-150 | | 119 | 50-150 |
| 13C6_PFDA | | 109 | 50-150 | | 111 | 50-150 |
| 13C7_PFUdA | | 107 | 50-150 | | 109 | 50-150 |
| 13C8_PFOA | | 104 | 50-150 | | 115 | 50-150 |
| 13C8_PFOS | | 104 | 50-150 | | 117 | 50-150 |
| 13C8_PFOSA | | 112 | 50-150 | | 110 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WL27010-012
Description: VRTB-S-M5_12152021
Matrix: Aqueous
Date Sampled: 12/15/2021 1640
Project Name: ESTCP Vertebrae
Date Received: 12/24/2021
Project Number: 30027244.00002

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 90 | 50-150 | | 116 | 50-150 |
| d5-EtFOSAA | | 121 | 50-150 | | 107 | 50-150 |
| d-MeFOSA | | 83 | 50-150 | | 100 | 50-150 |
| d3-MeFOSAA | | 114 | 50-150 | | 110 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL27010-013
Description: VRTB-D-S2_12152021 | Matrix: Aqueous
Date Sampled: 12/15/2021 1412 | Project Name: ESTCP Vertebrae
Date Received: 12/24/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/09/2022 2334 | JJG | 01/07/2022 1703 | 27771 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.0 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 5.1 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 13 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 130 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.0 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 6.6 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 13 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.3 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 25 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 8.8 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 170 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 102 | 50-150 |
| 13C2_6:2FTS | | 120 | 50-150 |
| 13C2_8:2FTS | | 118 | 50-150 |
| 13C2_PFDoA | | 93 | 50-150 |
| 13C2_PFTeDA | | 59 | 50-150 |
| 13C3_PFBS | | 104 | 50-150 |
| 13C3_PFHxS | | 110 | 50-150 |
| 13C4_PFBA | | 104 | 50-150 |
| 13C4_PFHpA | | 114 | 50-150 |
| 13C5_PFHxA | | 96 | 50-150 |
| 13C5_PFPeA | | 103 | 50-150 |
| 13C6_PFDA | | 113 | 50-150 |
| 13C7_PFUdA | | 109 | 50-150 |
| 13C8_PFOA | | 108 | 50-150 |
| 13C8_PFOS | | 110 | 50-150 |
| 13C8_PFOSA | | 112 | 50-150 |
| 13C9_PFNA | | 96 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL27010-013 |
| Description: VRTB-D-S2_12152021 | | | Matrix: Aqueous |
| Date Sampled: 12/15/2021 1412 | | Project Name: ESTCP Vertebrae | |
| Date Received: 12/24/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 115 | 50-150 |
| d-MeFOSA | | 84 | 50-150 |
| d3-MeFOSAA | | 115 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL27010-014
Description: VRTB-D-G4_12152021 | Matrix: Aqueous
Date Sampled: 12/15/2021 1315 | Project Name: ESTCP Vertebrae
Date Received: 12/24/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/09/2022 2345 | JJG | 01/07/2022 1703 | 27771 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 3.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.4 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 45 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.9 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 3.8 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 13 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 4.7 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 20 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 110 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 |
| 13C2_6:2FTS | | 110 | 50-150 |
| 13C2_8:2FTS | | 116 | 50-150 |
| 13C2_PFDoA | | 91 | 50-150 |
| 13C2_PFTeDA | | 69 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 |
| 13C4_PFBA | | 100 | 50-150 |
| 13C4_PFHpA | | 107 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 99 | 50-150 |
| 13C6_PFDA | | 106 | 50-150 |
| 13C7_PFUdA | | 105 | 50-150 |
| 13C8_PFOA | | 104 | 50-150 |
| 13C8_PFOS | | 108 | 50-150 |
| 13C8_PFOSA | | 109 | 50-150 |
| 13C9_PFNA | | 91 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL27010-014 |
| Description: VRTB-D-G4_12152021 | | | Matrix: Aqueous |
| Date Sampled: 12/15/2021 1315 | | Project Name: ESTCP Vertebrae | |
| Date Received: 12/24/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 110 | 50-150 |
| d-MeFOSA | | 94 | 50-150 |
| d3-MeFOSAA | | 108 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL27010-015
Description: VRTB-D-Y3_12152021 | Matrix: Aqueous
Date Sampled: 12/15/2021 1508 | Project Name: ESTCP Vertebrae
Date Received: 12/24/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/09/2022 2356 | JJG | 01/07/2022 1703 | 27771 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 1.9 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 1.9 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 1.9 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 1.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 3.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 1.9 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 3.1 | J | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.1 | J | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 5.7 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 57 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 4.1 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 3.7 | J | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 5.8 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 8.4 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 3.8 | J | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 100 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 |
| 13C2_6:2FTS | | 116 | 50-150 |
| 13C2_8:2FTS | | 119 | 50-150 |
| 13C2_PFDoA | | 100 | 50-150 |
| 13C2_PFTeDA | | 73 | 50-150 |
| 13C3_PFBS | | 105 | 50-150 |
| 13C3_PFHxS | | 111 | 50-150 |
| 13C4_PFBA | | 106 | 50-150 |
| 13C4_PFHpA | | 112 | 50-150 |
| 13C5_PFHxA | | 103 | 50-150 |
| 13C5_PFPeA | | 104 | 50-150 |
| 13C6_PFDA | | 112 | 50-150 |
| 13C7_PFUdA | | 111 | 50-150 |
| 13C8_PFOA | | 109 | 50-150 |
| 13C8_PFOS | | 113 | 50-150 |
| 13C8_PFOSA | | 115 | 50-150 |
| 13C9_PFNA | | 97 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WL27010-015 | |
| Description: VRTB-D-Y3_12152021 | | Matrix: Aqueous | |
| Date Sampled: 12/15/2021 1508 | Project Name: ESTCP Vertebrae | | |
| Date Received: 12/24/2021 | Project Number: 30027244.00002 | | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 124 | 50-150 |
| d-MeFOSA | | 104 | 50-150 |
| d3-MeFOSAA | | 116 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL27010-016
Description: VRTB-D-B1_12142021 | Matrix: Aqueous
Date Sampled: 12/14/2021 1710 | Project Name: ESTCP Vertebrae
Date Received: 12/24/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/10/2022 0007 | JJG | 01/07/2022 1703 | 27771 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.0 | J | 7.7 | 3.9 | 1.9 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 2.5 | J | 7.7 | 3.9 | 1.9 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.9 | U | 7.7 | 3.9 | 1.9 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.9 | U | 7.7 | 3.9 | 1.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.5 | U | 15 | 7.5 | 3.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.9 | U | 7.7 | 3.9 | 1.9 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 13 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 9.7 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 14 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 160 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 13 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 12 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 21 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 3.1 | J | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 22 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 17 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 700 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 |
| 13C2_6:2FTS | | 110 | 50-150 |
| 13C2_8:2FTS | | 112 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 |
| 13C2_PFTeDA | | 63 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 |
| 13C3_PFHxS | | 102 | 50-150 |
| 13C4_PFBA | | 81 | 50-150 |
| 13C4_PFHpA | | 104 | 50-150 |
| 13C5_PFHxA | | 96 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 |
| 13C6_PFDA | | 105 | 50-150 |
| 13C7_PFUdA | | 102 | 50-150 |
| 13C8_PFOA | | 102 | 50-150 |
| 13C8_PFOS | | 101 | 50-150 |
| 13C8_PFOSA | | 110 | 50-150 |
| 13C9_PFNA | | 87 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL27010-016 |
| Description: VRTB-D-B1_12142021 | | | Matrix: Aqueous |
| Date Sampled: 12/14/2021 1710 | | Project Name: ESTCP Vertebrae | |
| Date Received: 12/24/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 108 | 50-150 |
| d-MeFOSA | | 92 | 50-150 |
| d3-MeFOSAA | | 110 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: XQ27771-001
Batch: 27771
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/07/2022 1703

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/09/2022 1944 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/09/2022 1944 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/09/2022 1944 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/09/2022 1944 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 01/09/2022 1944 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/09/2022 1944 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/09/2022 1944 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 117 | 50-150 |
| 13C2_6:2FTS | | 126 | 50-150 |
| 13C2_8:2FTS | | 130 | 50-150 |
| 13C2_PFDoA | | 110 | 50-150 |
| 13C2_PFTeDA | | 111 | 50-150 |
| 13C3_PFBS | | 116 | 50-150 |
| 13C3_PFHxS | | 117 | 50-150 |
| 13C4_PFBA | | 112 | 50-150 |
| 13C4_PFHpA | | 125 | 50-150 |
| 13C5_PFHxA | | 112 | 50-150 |
| 13C5_PFPeA | | 113 | 50-150 |
| 13C6_PFDA | | 124 | 50-150 |
| 13C7_PFUdA | | 121 | 50-150 |
| 13C8_PFOA | | 118 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ27771-001
Batch: 27771
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/07/2022 1703

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 118 | 50-150 |
| 13C8_PFOSA | | 123 | 50-150 |
| 13C9_PFNA | | 108 | 50-150 |
| d5-EtFOSAA | | 125 | 50-150 |
| d-MeFOSA | | 95 | 50-150 |
| d3-MeFOSAA | | 121 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ27771-002
Batch: 27771
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/07/2022 1703

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 15 | | 1 | 98 | 67-138 | 01/09/2022 1955 |
| 6:2 FTS | 15 | 14 | | 1 | 92 | 64-140 | 01/09/2022 1955 |
| 4:2 FTS | 15 | 13 | | 1 | 90 | 63-143 | 01/09/2022 1955 |
| EtFOSAA | 16 | 17 | | 1 | 106 | 61-135 | 01/09/2022 1955 |
| MeFOSA | 16 | 19 | | 1 | 119 | 68-141 | 01/09/2022 1955 |
| MeFOSAA | 16 | 15 | | 1 | 93 | 65-136 | 01/09/2022 1955 |
| PFBS | 14 | 13 | | 1 | 94 | 72-130 | 01/09/2022 1955 |
| PFDS | 15 | 14 | | 1 | 89 | 53-142 | 01/09/2022 1955 |
| PFHpS | 15 | 15 | | 1 | 100 | 69-134 | 01/09/2022 1955 |
| PFNS | 15 | 15 | | 1 | 98 | 69-127 | 01/09/2022 1955 |
| PFOSA | 16 | 15 | | 1 | 95 | 67-137 | 01/09/2022 1955 |
| PFPeS | 15 | 15 | | 1 | 102 | 71-127 | 01/09/2022 1955 |
| PFHxS | 15 | 14 | | 1 | 96 | 68-131 | 01/09/2022 1955 |
| PFBA | 16 | 16 | | 1 | 97 | 73-129 | 01/09/2022 1955 |
| PFDA | 16 | 15 | | 1 | 95 | 71-129 | 01/09/2022 1955 |
| PFDoA | 16 | 16 | | 1 | 100 | 72-134 | 01/09/2022 1955 |
| PFHpA | 16 | 16 | | 1 | 98 | 72-130 | 01/09/2022 1955 |
| PFHxA | 16 | 15 | | 1 | 93 | 72-129 | 01/09/2022 1955 |
| PFNA | 16 | 15 | | 1 | 96 | 69-130 | 01/09/2022 1955 |
| PFOA | 16 | 15 | | 1 | 94 | 71-133 | 01/09/2022 1955 |
| PFPeA | 16 | 16 | | 1 | 100 | 72-129 | 01/09/2022 1955 |
| PFTeDA | 16 | 16 | | 1 | 102 | 71-132 | 01/09/2022 1955 |
| PFTrDA | 16 | 14 | | 1 | 86 | 65-144 | 01/09/2022 1955 |
| PFUdA | 16 | 15 | | 1 | 93 | 69-133 | 01/09/2022 1955 |
| PFOS | 15 | 15 | | 1 | 99 | 65-140 | 01/09/2022 1955 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 119 | 50-150 |
| 13C2_6:2FTS | | 123 | 50-150 |
| 13C2_8:2FTS | | 126 | 50-150 |
| 13C2_PFDoA | | 112 | 50-150 |
| 13C2_PFTeDA | | 113 | 50-150 |
| 13C3_PFBS | | 118 | 50-150 |
| 13C3_PFHxS | | 121 | 50-150 |
| 13C4_PFBA | | 113 | 50-150 |
| 13C4_PFHpA | | 121 | 50-150 |
| 13C5_PFHxA | | 117 | 50-150 |
| 13C5_PFPeA | | 116 | 50-150 |
| 13C6_PFDA | | 127 | 50-150 |
| 13C7_PFUdA | | 120 | 50-150 |
| 13C8_PFOA | | 117 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ27771-002
Batch: 27771
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/07/2022 1703

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 118 | 50-150 |
| 13C8_PFOSA | | 124 | 50-150 |
| 13C9_PFNA | | 107 | 50-150 |
| d5-EtFOSAA | | 122 | 50-150 |
| d-MeFOSA | | 98 | 50-150 |
| d3-MeFOSAA | | 121 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: WL27010-003MS
Batch: 27771
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/07/2022 1703

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | 15 | 15 | | 1 | 102 | 67-138 | 01/09/2022 2250 |
| 6:2 FTS | ND | 15 | 14 | | 1 | 93 | 64-140 | 01/09/2022 2250 |
| 4:2 FTS | ND | 14 | 12 | | 1 | 84 | 63-143 | 01/09/2022 2250 |
| EtFOSAA | ND | 16 | 13 | | 1 | 85 | 61-135 | 01/09/2022 2250 |
| MeFOSA | ND | 16 | 18 | | 1 | 114 | 68-141 | 01/09/2022 2250 |
| MeFOSAA | ND | 16 | 15 | | 1 | 98 | 65-136 | 01/09/2022 2250 |
| PFBS | 5.0 | 14 | 16 | | 1 | 84 | 72-130 | 01/09/2022 2250 |
| PFDS | ND | 15 | 12 | | 1 | 82 | 53-142 | 01/09/2022 2250 |
| PFHpS | 2.9 | 15 | 17 | | 1 | 93 | 69-134 | 01/09/2022 2250 |
| PFNS | ND | 15 | 13 | | 1 | 84 | 69-127 | 01/09/2022 2250 |
| PFOSA | ND | 16 | 14 | | 1 | 93 | 67-137 | 01/09/2022 2250 |
| PFPeS | 7.0 | 15 | 23 | | 1 | 109 | 71-127 | 01/09/2022 2250 |
| PFHxS | 85 | 14 | 96 | | 1 | 82 | 68-131 | 01/09/2022 2250 |
| PFBA | 14 | 16 | 28 | | 1 | 94 | 73-129 | 01/09/2022 2250 |
| PFDA | ND | 16 | 15 | | 1 | 95 | 71-129 | 01/09/2022 2250 |
| PFDoA | ND | 16 | 14 | | 1 | 91 | 72-134 | 01/09/2022 2250 |
| PFHpA | 4.8 | 16 | 19 | | 1 | 90 | 72-130 | 01/09/2022 2250 |
| PFHxA | 13 | 16 | 27 | | 1 | 91 | 72-129 | 01/09/2022 2250 |
| PFNA | ND | 16 | 14 | | 1 | 92 | 69-130 | 01/09/2022 2250 |
| PFOA | 6.7 | 16 | 21 | | 1 | 94 | 71-133 | 01/09/2022 2250 |
| PFPeA | 9.5 | 16 | 25 | | 1 | 97 | 72-129 | 01/09/2022 2250 |
| PFTeDA | ND | 16 | 15 | | 1 | 96 | 71-132 | 01/09/2022 2250 |
| PFTrDA | ND | 16 | 13 | | 1 | 82 | 65-144 | 01/09/2022 2250 |
| PFUdA | ND | 16 | 14 | | 1 | 89 | 69-133 | 01/09/2022 2250 |
| PFOS | 58 | 14 | 69 | | 1 | 78 | 65-140 | 01/09/2022 2250 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 116 | 50-150 |
| 13C2_6:2FTS | | 122 | 50-150 |
| 13C2_8:2FTS | | 125 | 50-150 |
| 13C2_PFDoA | | 109 | 50-150 |
| 13C2_PFTeDA | | 112 | 50-150 |
| 13C3_PFBS | | 114 | 50-150 |
| 13C3_PFHxS | | 118 | 50-150 |
| 13C4_PFBA | | 107 | 50-150 |
| 13C4_PFHpA | | 121 | 50-150 |
| 13C5_PFHxA | | 109 | 50-150 |
| 13C5_PFPeA | | 110 | 50-150 |
| 13C6_PFDA | | 119 | 50-150 |
| 13C7_PFUdA | | 117 | 50-150 |
| 13C8_PFOA | | 116 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: WL27010-003MS
Batch: 27771
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/07/2022 1703

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 121 | 50-150 |
| 13C8_PFOSA | | 119 | 50-150 |
| 13C9_PFNA | | 104 | 50-150 |
| d5-EtFOSAA | | 127 | 50-150 |
| d-MeFOSA | | 102 | 50-150 |
| d3-MeFOSAA | | 126 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: WL27010-003MD
Batch: 27771
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/07/2022 1703

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | 14 | 13 | | 1 | 94 | 12 | 67-138 | 30 | 01/09/2022 2301 |
| 6:2 FTS | ND | 14 | 12 | | 1 | 84 | 14 | 64-140 | 30 | 01/09/2022 2301 |
| 4:2 FTS | ND | 14 | 12 | | 1 | 90 | 2.2 | 63-143 | 30 | 01/09/2022 2301 |
| EtFOSAA | ND | 15 | 15 | | 1 | 99 | 10 | 61-135 | 30 | 01/09/2022 2301 |
| MeFOSA | ND | 15 | 16 | | 1 | 110 | 8.8 | 68-141 | 30 | 01/09/2022 2301 |
| MeFOSAA | ND | 15 | 15 | | 1 | 103 | 0.18 | 65-136 | 30 | 01/09/2022 2301 |
| PFBS | 5.0 | 13 | 16 | | 1 | 86 | 1.4 | 72-130 | 30 | 01/09/2022 2301 |
| PFDS | ND | 14 | 12 | | 1 | 82 | 5.0 | 53-142 | 30 | 01/09/2022 2301 |
| PFHpS | 2.9 | 14 | 16 | | 1 | 90 | 6.8 | 69-134 | 30 | 01/09/2022 2301 |
| PFNS | ND | 14 | 12 | | 1 | 86 | 2.8 | 69-127 | 30 | 01/09/2022 2301 |
| PFOSA | ND | 15 | 14 | | 1 | 95 | 2.3 | 67-137 | 30 | 01/09/2022 2301 |
| PFPeS | 7.0 | 14 | 21 | | 1 | 100 | 9.3 | 71-127 | 30 | 01/09/2022 2301 |
| PFHxS | 85 | 13 | 100 | | 1 | 119 | 4.4 | 68-131 | 30 | 01/09/2022 2301 |
| PFBA | 14 | 15 | 27 | | 1 | 94 | 2.4 | 73-129 | 30 | 01/09/2022 2301 |
| PFDA | ND | 15 | 13 | | 1 | 89 | 12 | 71-129 | 30 | 01/09/2022 2301 |
| PFDoA | ND | 15 | 14 | | 1 | 94 | 1.8 | 72-134 | 30 | 01/09/2022 2301 |
| PFHpA | 4.8 | 15 | 18 | | 1 | 88 | 5.7 | 72-130 | 30 | 01/09/2022 2301 |
| PFHxA | 13 | 15 | 25 | | 1 | 82 | 7.3 | 72-129 | 30 | 01/09/2022 2301 |
| PFNA | ND | 15 | 14 | | 1 | 95 | 1.6 | 69-130 | 30 | 01/09/2022 2301 |
| PFOA | 6.7 | 15 | 21 | | 1 | 96 | 1.7 | 71-133 | 30 | 01/09/2022 2301 |
| PFPeA | 9.5 | 15 | 23 | | 1 | 90 | 7.1 | 72-129 | 30 | 01/09/2022 2301 |
| PFTeDA | ND | 15 | 14 | | 1 | 98 | 2.9 | 71-132 | 30 | 01/09/2022 2301 |
| PFTrDA | ND | 15 | 12 | | 1 | 83 | 3.9 | 65-144 | 30 | 01/09/2022 2301 |
| PFUdA | ND | 15 | 14 | | 1 | 93 | 0.77 | 69-133 | 30 | 01/09/2022 2301 |
| PFOS | 58 | 14 | 72 | | 1 | 96 | 2.9 | 65-140 | 30 | 01/09/2022 2301 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 |
| 13C2_6:2FTS | | 125 | 50-150 |
| 13C2_8:2FTS | | 125 | 50-150 |
| 13C2_PFDoA | | 108 | 50-150 |
| 13C2_PFTeDA | | 108 | 50-150 |
| 13C3_PFBS | | 109 | 50-150 |
| 13C3_PFHxS | | 115 | 50-150 |
| 13C4_PFBA | | 107 | 50-150 |
| 13C4_PFHpA | | 121 | 50-150 |
| 13C5_PFHxA | | 113 | 50-150 |
| 13C5_PFPeA | | 112 | 50-150 |
| 13C6_PFDA | | 121 | 50-150 |
| 13C7_PFUdA | | 116 | 50-150 |
| 13C8_PFOA | | 115 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: WL27010-003MD
Batch: 27771
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/07/2022 1703

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 118 | 50-150 |
| 13C8_PFOSA | | 123 | 50-150 |
| 13C9_PFNA | | 105 | 50-150 |
| d5-EtFOSAA | | 123 | 50-150 |
| d-MeFOSA | | 97 | 50-150 |
| d3-MeFOSAA | | 121 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803 791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 128455

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck | Telephone No. / E-mail: 231-534-5092 | Quote No. |
| Address: 28550 Cabot Drive, Ste 500 | Sampler's Signature: X | Analysis (Attach list if more space is needed) | Page 1 of 2 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Kristen Hasbrouck | | |
| Project Name: ESTCP Grayling Verification | | | |
| Project No.: 30027244.00002 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab / Composite | Matrix: Aqueous | Matrix: Solid / Non-Aqueous | Matrix: Oil | No. of Containers by Preservative Type: Unpres. | HNO3 | H2SO4 | NaOH | Na2S2O3 | Methanol | Other | PFAS - QSM Table B-15 | Trip TOF | TOP Assay | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dup-01_12132021 | 12/13 | — | G | X | | | 2 | | | | | | | X | | | |
| MW-VRTB-2S_12132021 | 12/13 | 1325 | G | X | | | 2 | | | | | | | X | | | |
| MW-VRTB-2D_12132021 | 12/13 | 1215 | G | X | | | 6 | | | | | | | X | | | MS/MSD |
| CMT-VRTB-01-1_12172021 | 12/17 | 1513 | G | X | | | 6 | | | | | | | X | X | X | Date in ID is "12172021" |
| CMT-VRTB-01-2_12172021 | 12/17 | 1400 | G | X | | | 6 | | | | | | | X | X | X | |
| CMT-VRTB-01-3_12172021 | 12/17 | 1157 | G | X | | | 6 | | | | | | | X | X | X | |
| CMT-VRTB-01-4_12172021 | 12/17 | 1118 | G | X | | | 6 | | | | | | | X | X | X | |
| CMT-VRTB-01-5_12172021 | 12/17 | 1416 | G | X | | | 6 | | | | | | | X | X | X | |
| CMT-VRTB-01-6_12172021 | 12/17 | 1155 | G | X | | | 6 | | | | | | | X | X | X | |
| CMT-VRTB-01-7_12172021 | 12/17 | 1110 | G | X | | | 6 | | | | | | | X | X | X | |

WL27010

Kits:

| | | | |
|---|---|---|---|
| Turn Around Time Required (Prior lab approval required for expedited TAT.): Standard / Rush (Specify) | Sample Disposal: Return to Client / Disposal by Lab | Possible Hazard Identification: Non-Hazard / Flammable / Skin Irritant / Poison / Unknown | QC Requirements (Specify): Level II, EDD |
| 1. Relinquished by: Kristen Hasbrouck — Date: 12/21/21 — Time: | 1. Received by: FedEx — Date: 12/21/21 — Time: | | |
| 2. Relinquished by: — Date: — Time: | 2. Received by: — Date: — Time: | | |
| 3. Relinquished by: — Date: — Time: | 3. Received by: — Date: — Time: | | |
| 4. Relinquished by: fedex — Date: — Time: 1622 | 4. Laboratory received by: [illegible] — Date: 12/22/21 — Time: 1622 | | |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle): (Yes) No Ice Pack — Receipt Temp: 3.0 °C 5.0 — Temp Blank: Y N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: IAE003N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 128456

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck | Telephone No. / E-mail: 231-534-5092 | Quote No. |
| Address: 28550 Cabot Dr Ste 500 | Sampler's Signature: | Analysis (Attach list if more space is needed) | Page 2 of 2 |
| City: Novi | State: MI | Zip Code: 48377 | Printed Name: Kristen Hasbrouck | | |
| Project Name: ESTCP Grayling Vertebrae | | | |
| Project No.: 30027244.00002 | P.O. No.: | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab / Composite | Matrix: Aqueous | Soil | Non-Aqueous | No of Containers by Preservative Type: Unpres | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | Methanol | PFAS - QSM Table B-15 | True TOP | Total Assay | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-S-Orange_12132021 | 12/13 | 1650 | G | X | | | 2 | | | | | | | X | | | |
| VRTB-S-Pink_12152021 | 12/15 | 1640 | G | X | | | 2 | | | | | | | X | | | |
| VRTB-D-Gray_12152021 | 12/15 | 1412 | G | X | | | 2 | | | | | | | X | | | |
| VRTB-D-Green_12152021 | 12/15 | 1315 | G | X | | | 2 | | | | | | | X | | | |
| VRTB-D-Yellow_12152021 | 12/15 | 1508 | G | X | | | 2 | | | | | | | X | | | |
| VRTB-D-Black_12142021 | 12/14 | 1710 | G | X | | | 2 | | | | | | | X | | | |

WL27010

KES2

Expect high concentrations in these (all) samples

| | | | | | | |
|---|---|---|---|---|---|---|
| Turn Around Time Required (Prior lab approval required for expedited TAT.) ☑ Standard ☐ Rush (Specify) | Sample Disposal ☐ Return to Client ☑ Disposal by Lab | Possible Hazard Identification ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown | QC Requirements (Specify) Level III, EDD | | | |
| 1. Relinquished by: Kristen Hasbrouck | Date: 12/21/21 | Time: | 1. Received by: FedEx | Date: 12/21/21 | Time: |
| 2. Relinquished by: | Date: | Time: | 2. Received by: | Date: | Time: |
| 3. Relinquished by: | Date: | Time: | 3. Received by: | Date: | Time: |
| 4. Relinquished by: fedex | Date: | Time: 1622 | 4. Laboratory received by: | Date: 12/24/21 | Time: 1622 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle) (Yes) No Ice Pack — Receipt Temp: 3.0 °C 5.0°C — Temp Blank ☐ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s), PINK Field/Client Copy

Document Number: ME003N2-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

# Sample Receipt Checklist (SRC)

Client: Arcadis  Cooler inspected by/date: KDRW / 12/27/2021  Lot #: WL27010

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

| | | | |
|---|---|---|---|
| ☐ Yes | ☑ No | | 1. Were custody seals present on the cooler? |
| ☐ Yes | ☐ No | ☑ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: NA

5.0 / 5.0 °C  3.0 / 3.6 °C  NA / NA °C  NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles  IR Gun ID: 6  IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☐ Yes | ☐ No | ☑ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? _____ |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☐ Yes | ☑ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS? |
| ☑ Yes | ☐ No | | 21. Was the quote number listed on the container label? If yes, Quote # 25221 |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.

Time of preservation: NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: KDRW Date: 12/27/2021

Comments:

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP GAAF Vertebrae

Project Number: 30027244.00002

Lot Number:**WL30065**

Date Completed:01/20/2022

01/21/2022 4:08 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: WL30065

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

For sample WL30065-020, sample matrix prevented full volume from being extracted, precluding method mandated bottle rinse. Elution solvent was aliquoted directly into the reservoir, rinsing the inside. Surrogate recovery may be adversely affected.

Surrogate recovery for the following samples was outside control limits: WL30065-005, WL30065-006, WL30065-007, WL30065-008, WL30065-020. Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

The MS/MSD associated with sample WL30065-006 had multiple compounds recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: WL30065

Project Name: ESTCP GAAF Vertebrae

Project Number: 30027244.00002

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | MW-VRTB-2S_12272021 | Aqueous | 12/27/2021 1509 | 12/30/2021 |
| 002 | MW-VRTB-2D_12272021 | Aqueous | 12/27/2021 1535 | 12/30/2021 |
| 003 | MW-VRTB-3_12272021 | Aqueous | 12/27/2021 1639 | 12/30/2021 |
| 004 | Dup-02_12272021 | Aqueous | 12/27/2021 | 12/30/2021 |
| 005 | VRTB-L-B1_12272021 | Aqueous | 12/27/2021 1242 | 12/30/2021 |
| 006 | VRTB-L-S2_12272021 | Aqueous | 12/27/2021 1147 | 12/30/2021 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | 12/27/2021 1148 | 12/30/2021 |
| 008 | VRTB-L-G4_12272021 | Aqueous | 12/27/2021 1100 | 12/30/2021 |
| 009 | VRTB-L-M5_12232021 | Aqueous | 12/23/2021 1515 | 12/30/2021 |
| 010 | VRTB-L-06_12232021 | Aqueous | 12/23/2021 1653 | 12/30/2021 |
| 011 | VRTB-L-P7_12232021 | Aqueous | 12/23/2021 1638 | 12/30/2021 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | 12/27/2021 1355 | 12/30/2021 |
| 013 | VRTB-S-B1_12232021 | Aqueous | 12/23/2021 1318 | 12/30/2021 |
| 014 | VRTB-S-S2_12232021 | Aqueous | 12/23/2021 1145 | 12/30/2021 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | 12/23/2021 1227 | 12/30/2021 |
| 016 | VRTB-S-G4_12232021 | Aqueous | 12/23/2021 1125 | 12/30/2021 |
| 017 | VRTB-D-M5_12212021 | Aqueous | 12/21/2021 1605 | 12/30/2021 |
| 018 | VRTB-D-06_12212021 | Aqueous | 12/21/2021 1421 | 12/30/2021 |
| 019 | VRTB-D-R7_12212021 | Aqueous | 12/21/2021 1545 | 12/30/2021 |
| 020 | VRTB-D-P8_12212021 | Aqueous | 12/21/2021 1424 | 12/30/2021 |

(20 samples)

# Detection Summary

## Arcadis U.S., Inc.

Lot Number: WL30065

Project Name: ESTCP GAAF Vertebrae

Project Number: 30027244.00002

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | MW-VRTB-2S_12272021 | Aqueous | 8:2 FTS | PFAS by ID | 9.5 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | 6:2 FTS | PFAS by ID | 20 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | PFBS | PFAS by ID | 14 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | PFHpS | PFAS by ID | 31 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | PFPeS | PFAS by ID | 33 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | PFHxS | PFAS by ID | 770 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | PFBA | PFAS by ID | 49 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | PFHpA | PFAS by ID | 110 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | PFHxA | PFAS by ID | 140 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | PFNA | PFAS by ID | 31 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | PFOA | PFAS by ID | 84 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | PFPeA | PFAS by ID | 130 | | ng/L | 10 |
| 001 | MW-VRTB-2S_12272021 | Aqueous | PFOS | PFAS by ID | 9500 | | ng/L | 10 |
| 002 | MW-VRTB-2D_12272021 | Aqueous | PFBS | PFAS by ID | 14 | | ng/L | 12 |
| 002 | MW-VRTB-2D_12272021 | Aqueous | PFHpS | PFAS by ID | 13 | | ng/L | 12 |
| 002 | MW-VRTB-2D_12272021 | Aqueous | PFPeS | PFAS by ID | 19 | | ng/L | 12 |
| 002 | MW-VRTB-2D_12272021 | Aqueous | PFHxS | PFAS by ID | 290 | | ng/L | 12 |
| 002 | MW-VRTB-2D_12272021 | Aqueous | PFBA | PFAS by ID | 15 | | ng/L | 12 |
| 002 | MW-VRTB-2D_12272021 | Aqueous | PFHpA | PFAS by ID | 10 | | ng/L | 12 |
| 002 | MW-VRTB-2D_12272021 | Aqueous | PFHxA | PFAS by ID | 21 | | ng/L | 12 |
| 002 | MW-VRTB-2D_12272021 | Aqueous | PFOA | PFAS by ID | 36 | | ng/L | 12 |
| 002 | MW-VRTB-2D_12272021 | Aqueous | PFPeA | PFAS by ID | 17 | | ng/L | 12 |
| 002 | MW-VRTB-2D_12272021 | Aqueous | PFOS | PFAS by ID | 240 | | ng/L | 12 |
| 003 | MW-VRTB-3_12272021 | Aqueous | PFBS | PFAS by ID | 2.7 | J | ng/L | 14 |
| 003 | MW-VRTB-3_12272021 | Aqueous | PFHpS | PFAS by ID | 7.6 | | ng/L | 14 |
| 003 | MW-VRTB-3_12272021 | Aqueous | PFPeS | PFAS by ID | 2.8 | J | ng/L | 14 |
| 003 | MW-VRTB-3_12272021 | Aqueous | PFHxS | PFAS by ID | 120 | | ng/L | 14 |
| 003 | MW-VRTB-3_12272021 | Aqueous | PFBA | PFAS by ID | 3.8 | J | ng/L | 14 |
| 003 | MW-VRTB-3_12272021 | Aqueous | PFHpA | PFAS by ID | 3.9 | J | ng/L | 14 |
| 003 | MW-VRTB-3_12272021 | Aqueous | PFHxA | PFAS by ID | 9.2 | | ng/L | 14 |
| 003 | MW-VRTB-3_12272021 | Aqueous | PFNA | PFAS by ID | 7.0 | | ng/L | 14 |
| 003 | MW-VRTB-3_12272021 | Aqueous | PFOA | PFAS by ID | 11 | | ng/L | 14 |
| 003 | MW-VRTB-3_12272021 | Aqueous | PFPeA | PFAS by ID | 4.9 | | ng/L | 14 |
| 003 | MW-VRTB-3_12272021 | Aqueous | PFOS | PFAS by ID | 800 | | ng/L | 14 |
| 004 | Dup-02_12272021 | Aqueous | PFBS | PFAS by ID | 2.6 | J | ng/L | 16 |
| 004 | Dup-02_12272021 | Aqueous | PFHpS | PFAS by ID | 7.4 | | ng/L | 16 |
| 004 | Dup-02_12272021 | Aqueous | PFPeS | PFAS by ID | 2.6 | J | ng/L | 16 |
| 004 | Dup-02_12272021 | Aqueous | PFHxS | PFAS by ID | 110 | | ng/L | 16 |
| 004 | Dup-02_12272021 | Aqueous | PFBA | PFAS by ID | 3.7 | J | ng/L | 16 |
| 004 | Dup-02_12272021 | Aqueous | PFHpA | PFAS by ID | 4.0 | | ng/L | 16 |
| 004 | Dup-02_12272021 | Aqueous | PFHxA | PFAS by ID | 10 | | ng/L | 16 |
| 004 | Dup-02_12272021 | Aqueous | PFNA | PFAS by ID | 7.5 | | ng/L | 16 |
| 004 | Dup-02_12272021 | Aqueous | PFOA | PFAS by ID | 11 | | ng/L | 16 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 004 | Dup-02_12272021 | Aqueous | PFPeA | PFAS by ID | 5.1 | | ng/L | 16 |
| 004 | Dup-02_12272021 | Aqueous | PFOS | PFAS by ID | 900 | | ng/L | 16 |
| 005 | VRTB-L-B1_12272021 | Aqueous | 8:2 FTS | PFAS by ID | 6.6 | J | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | 6:2 FTS | PFAS by ID | 2.5 | J | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | PFBS | PFAS by ID | 5.3 | | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | PFHpS | PFAS by ID | 12 | | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | PFPeS | PFAS by ID | 9.3 | | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | PFHxS | PFAS by ID | 150 | | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | PFBA | PFAS by ID | 6.1 | | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | PFHpA | PFAS by ID | 7.3 | | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | PFHxA | PFAS by ID | 15 | | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | PFNA | PFAS by ID | 11 | | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | PFOA | PFAS by ID | 26 | | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | PFPeA | PFAS by ID | 10 | | ng/L | 18 |
| 005 | VRTB-L-B1_12272021 | Aqueous | PFOS | PFAS by ID | 1200 | | ng/L | 18 |
| 006 | VRTB-L-S2_12272021 | Aqueous | 8:2 FTS | PFAS by ID | 3.8 | J | ng/L | 20 |
| 006 | VRTB-L-S2_12272021 | Aqueous | PFBS | PFAS by ID | 10 | | ng/L | 20 |
| 006 | VRTB-L-S2_12272021 | Aqueous | PFHpS | PFAS by ID | 10 | | ng/L | 20 |
| 006 | VRTB-L-S2_12272021 | Aqueous | PFPeS | PFAS by ID | 14 | | ng/L | 20 |
| 006 | VRTB-L-S2_12272021 | Aqueous | PFHxS | PFAS by ID | 190 | S | ng/L | 20 |
| 006 | VRTB-L-S2_12272021 | Aqueous | PFBA | PFAS by ID | 9.4 | | ng/L | 20 |
| 006 | VRTB-L-S2_12272021 | Aqueous | PFHpA | PFAS by ID | 8.8 | | ng/L | 20 |
| 006 | VRTB-L-S2_12272021 | Aqueous | PFHxA | PFAS by ID | 18 | | ng/L | 20 |
| 006 | VRTB-L-S2_12272021 | Aqueous | PFNA | PFAS by ID | 2.7 | J | ng/L | 20 |
| 006 | VRTB-L-S2_12272021 | Aqueous | PFOA | PFAS by ID | 32 | | ng/L | 20 |
| 006 | VRTB-L-S2_12272021 | Aqueous | PFPeA | PFAS by ID | 14 | | ng/L | 20 |
| 006 | VRTB-L-S2_12272021 | Aqueous | PFOS | PFAS by ID | 430 | S | ng/L | 20 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | 8:2 FTS | PFAS by ID | 15 | | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | 6:2 FTS | PFAS by ID | 5.5 | J | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | PFBS | PFAS by ID | 5.4 | | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | PFHpS | PFAS by ID | 9.1 | | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | PFPeS | PFAS by ID | 7.9 | | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | PFHxS | PFAS by ID | 130 | | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | PFBA | PFAS by ID | 14 | | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | PFHpA | PFAS by ID | 11 | | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | PFHxA | PFAS by ID | 18 | | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | PFNA | PFAS by ID | 3.7 | J | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | PFOA | PFAS by ID | 23 | | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | PFPeA | PFAS by ID | 14 | | ng/L | 22 |
| 007 | VRTB-L-Y3_12272021 | Aqueous | PFOS | PFAS by ID | 720 | | ng/L | 22 |
| 008 | VRTB-L-G4_12272021 | Aqueous | 8:2 FTS | PFAS by ID | 19 | | ng/L | 24 |
| 008 | VRTB-L-G4_12272021 | Aqueous | 6:2 FTS | PFAS by ID | 7.8 | | ng/L | 24 |
| 008 | VRTB-L-G4_12272021 | Aqueous | PFBS | PFAS by ID | 8.2 | | ng/L | 24 |
| 008 | VRTB-L-G4_12272021 | Aqueous | PFHpS | PFAS by ID | 10 | | ng/L | 24 |
| 008 | VRTB-L-G4_12272021 | Aqueous | PFPeS | PFAS by ID | 11 | | ng/L | 24 |
| 008 | VRTB-L-G4_12272021 | Aqueous | PFHxS | PFAS by ID | 160 | | ng/L | 24 |
| 008 | VRTB-L-G4_12272021 | Aqueous | PFBA | PFAS by ID | 13 | | ng/L | 24 |
| 008 | VRTB-L-G4_12272021 | Aqueous | PFHpA | PFAS by ID | 15 | | ng/L | 24 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 008 | VRTB-L-G4_12272021 | Aqueous | PFHxA | PFAS by ID | 21 | | ng/L | 24 |
| 008 | VRTB-L-G4_12272021 | Aqueous | PFNA | PFAS by ID | 5.4 | | ng/L | 24 |
| 008 | VRTB-L-G4_12272021 | Aqueous | PFOA | PFAS by ID | 28 | | ng/L | 24 |
| 008 | VRTB-L-G4_12272021 | Aqueous | PFPeA | PFAS by ID | 20 | | ng/L | 24 |
| 008 | VRTB-L-G4_12272021 | Aqueous | PFOS | PFAS by ID | 1000 | | ng/L | 24 |
| 009 | VRTB-L-M5_12232021 | Aqueous | 8:2 FTS | PFAS by ID | 72 | J | ng/L | 26 |
| 009 | VRTB-L-M5_12232021 | Aqueous | 6:2 FTS | PFAS by ID | 82 | | ng/L | 26 |
| 009 | VRTB-L-M5_12232021 | Aqueous | PFHpS | PFAS by ID | 36 | J | ng/L | 26 |
| 009 | VRTB-L-M5_12232021 | Aqueous | PFPeS | PFAS by ID | 10 | J | ng/L | 26 |
| 009 | VRTB-L-M5_12232021 | Aqueous | PFHxS | PFAS by ID | 620 | | ng/L | 26 |
| 009 | VRTB-L-M5_12232021 | Aqueous | PFBA | PFAS by ID | 24 | J | ng/L | 26 |
| 009 | VRTB-L-M5_12232021 | Aqueous | PFHpA | PFAS by ID | 85 | | ng/L | 26 |
| 009 | VRTB-L-M5_12232021 | Aqueous | PFHxA | PFAS by ID | 80 | | ng/L | 26 |
| 009 | VRTB-L-M5_12232021 | Aqueous | PFNA | PFAS by ID | 50 | | ng/L | 26 |
| 009 | VRTB-L-M5_12232021 | Aqueous | PFOA | PFAS by ID | 110 | | ng/L | 26 |
| 009 | VRTB-L-M5_12232021 | Aqueous | PFPeA | PFAS by ID | 83 | | ng/L | 26 |
| 009 | VRTB-L-M5_12232021 | Aqueous | PFOS | PFAS by ID | 11000 | | ng/L | 26 |
| 010 | VRTB-L-06_12232021 | Aqueous | 6:2 FTS | PFAS by ID | 110 | J | ng/L | 28 |
| 010 | VRTB-L-06_12232021 | Aqueous | PFHpS | PFAS by ID | 61 | J | ng/L | 28 |
| 010 | VRTB-L-06_12232021 | Aqueous | PFHxS | PFAS by ID | 1100 | | ng/L | 28 |
| 010 | VRTB-L-06_12232021 | Aqueous | PFHpA | PFAS by ID | 130 | | ng/L | 28 |
| 010 | VRTB-L-06_12232021 | Aqueous | PFHxA | PFAS by ID | 110 | | ng/L | 28 |
| 010 | VRTB-L-06_12232021 | Aqueous | PFNA | PFAS by ID | 63 | J | ng/L | 28 |
| 010 | VRTB-L-06_12232021 | Aqueous | PFOA | PFAS by ID | 200 | | ng/L | 28 |
| 010 | VRTB-L-06_12232021 | Aqueous | PFPeA | PFAS by ID | 120 | | ng/L | 28 |
| 010 | VRTB-L-06_12232021 | Aqueous | PFOS | PFAS by ID | 13000 | | ng/L | 28 |
| 011 | VRTB-L-P7_12232021 | Aqueous | 8:2 FTS | PFAS by ID | 29 | J | ng/L | 30 |
| 011 | VRTB-L-P7_12232021 | Aqueous | 6:2 FTS | PFAS by ID | 60 | J | ng/L | 30 |
| 011 | VRTB-L-P7_12232021 | Aqueous | PFHpS | PFAS by ID | 40 | | ng/L | 30 |
| 011 | VRTB-L-P7_12232021 | Aqueous | PFPeS | PFAS by ID | 15 | J | ng/L | 30 |
| 011 | VRTB-L-P7_12232021 | Aqueous | PFHxS | PFAS by ID | 820 | | ng/L | 30 |
| 011 | VRTB-L-P7_12232021 | Aqueous | PFBA | PFAS by ID | 23 | J | ng/L | 30 |
| 011 | VRTB-L-P7_12232021 | Aqueous | PFHpA | PFAS by ID | 96 | | ng/L | 30 |
| 011 | VRTB-L-P7_12232021 | Aqueous | PFHxA | PFAS by ID | 90 | | ng/L | 30 |
| 011 | VRTB-L-P7_12232021 | Aqueous | PFNA | PFAS by ID | 39 | J | ng/L | 30 |
| 011 | VRTB-L-P7_12232021 | Aqueous | PFOA | PFAS by ID | 110 | | ng/L | 30 |
| 011 | VRTB-L-P7_12232021 | Aqueous | PFPeA | PFAS by ID | 74 | | ng/L | 30 |
| 011 | VRTB-L-P7_12232021 | Aqueous | PFOS | PFAS by ID | 10000 | | ng/L | 30 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | 6:2 FTS | PFAS by ID | 28 | J | ng/L | 32 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | PFBS | PFAS by ID | 11 | J | ng/L | 32 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | PFHpS | PFAS by ID | 38 | J | ng/L | 32 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | PFPeS | PFAS by ID | 23 | J | ng/L | 32 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | PFHxS | PFAS by ID | 740 | | ng/L | 32 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | PFBA | PFAS by ID | 26 | J | ng/L | 32 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | PFHpA | PFAS by ID | 68 | | ng/L | 32 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | PFHxA | PFAS by ID | 93 | | ng/L | 32 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | PFNA | PFAS by ID | 34 | J | ng/L | 32 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | PFOA | PFAS by ID | 73 | | ng/L | 32 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 012 | VRTB-L-BB8_12272021 | Aqueous | PFPeA | PFAS by ID | 68 | | ng/L | 32 |
| 012 | VRTB-L-BB8_12272021 | Aqueous | PFOS | PFAS by ID | 7900 | | ng/L | 32 |
| 013 | VRTB-S-B1_12232021 | Aqueous | PFBS | PFAS by ID | 1.4 | J | ng/L | 34 |
| 013 | VRTB-S-B1_12232021 | Aqueous | PFHpS | PFAS by ID | 1.0 | J | ng/L | 34 |
| 013 | VRTB-S-B1_12232021 | Aqueous | PFPeS | PFAS by ID | 1.1 | J | ng/L | 34 |
| 013 | VRTB-S-B1_12232021 | Aqueous | PFHxS | PFAS by ID | 17 | | ng/L | 34 |
| 013 | VRTB-S-B1_12232021 | Aqueous | PFHpA | PFAS by ID | 1.5 | J | ng/L | 34 |
| 013 | VRTB-S-B1_12232021 | Aqueous | PFHxA | PFAS by ID | 2.5 | J | ng/L | 34 |
| 013 | VRTB-S-B1_12232021 | Aqueous | PFOA | PFAS by ID | 2.5 | J | ng/L | 34 |
| 013 | VRTB-S-B1_12232021 | Aqueous | PFPeA | PFAS by ID | 2.7 | J | ng/L | 34 |
| 013 | VRTB-S-B1_12232021 | Aqueous | PFOS | PFAS by ID | 180 | | ng/L | 34 |
| 014 | VRTB-S-S2_12232021 | Aqueous | 8:2 FTS | PFAS by ID | 6.5 | J | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | 6:2 FTS | PFAS by ID | 8.1 | J | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | PFBS | PFAS by ID | 4.2 | | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | PFHpS | PFAS by ID | 7.8 | | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | PFPeS | PFAS by ID | 7.3 | | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | PFHxS | PFAS by ID | 200 | | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | PFBA | PFAS by ID | 11 | | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | PFHpA | PFAS by ID | 33 | | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | PFHxA | PFAS by ID | 26 | | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | PFNA | PFAS by ID | 8.0 | | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | PFOA | PFAS by ID | 26 | | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | PFPeA | PFAS by ID | 19 | | ng/L | 36 |
| 014 | VRTB-S-S2_12232021 | Aqueous | PFOS | PFAS by ID | 1000 | | ng/L | 36 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | 8:2 FTS | PFAS by ID | 6.5 | J | ng/L | 38 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | PFBS | PFAS by ID | 10 | | ng/L | 38 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | PFHpS | PFAS by ID | 20 | | ng/L | 38 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | PFPeS | PFAS by ID | 27 | | ng/L | 38 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | PFHxS | PFAS by ID | 490 | | ng/L | 38 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | PFBA | PFAS by ID | 8.4 | | ng/L | 38 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | PFHpA | PFAS by ID | 15 | | ng/L | 38 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | PFHxA | PFAS by ID | 31 | | ng/L | 38 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | PFNA | PFAS by ID | 4.5 | | ng/L | 38 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | PFOA | PFAS by ID | 18 | | ng/L | 38 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | PFPeA | PFAS by ID | 15 | | ng/L | 38 |
| 015 | VRTB-S-Y3_12232021 | Aqueous | PFOS | PFAS by ID | 1500 | | ng/L | 38 |
| 016 | VRTB-S-G4_12232021 | Aqueous | PFBS | PFAS by ID | 6.8 | | ng/L | 40 |
| 016 | VRTB-S-G4_12232021 | Aqueous | PFHpS | PFAS by ID | 7.5 | | ng/L | 40 |
| 016 | VRTB-S-G4_12232021 | Aqueous | PFPeS | PFAS by ID | 8.7 | | ng/L | 40 |
| 016 | VRTB-S-G4_12232021 | Aqueous | PFHxS | PFAS by ID | 160 | | ng/L | 40 |
| 016 | VRTB-S-G4_12232021 | Aqueous | PFBA | PFAS by ID | 2.7 | J | ng/L | 40 |
| 016 | VRTB-S-G4_12232021 | Aqueous | PFHpA | PFAS by ID | 2.5 | J | ng/L | 40 |
| 016 | VRTB-S-G4_12232021 | Aqueous | PFHxA | PFAS by ID | 3.4 | J | ng/L | 40 |
| 016 | VRTB-S-G4_12232021 | Aqueous | PFNA | PFAS by ID | 1.5 | J | ng/L | 40 |
| 016 | VRTB-S-G4_12232021 | Aqueous | PFOA | PFAS by ID | 4.5 | | ng/L | 40 |
| 016 | VRTB-S-G4_12232021 | Aqueous | PFPeA | PFAS by ID | 1.6 | J | ng/L | 40 |
| 016 | VRTB-S-G4_12232021 | Aqueous | PFOS | PFAS by ID | 570 | | ng/L | 40 |
| 017 | VRTB-D-M5_12212021 | Aqueous | PFBS | PFAS by ID | 2.9 | J | ng/L | 42 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 017 | VRTB-D-M5_12212021 | Aqueous | PFHpS | PFAS by ID | 4.8 | | ng/L | 42 |
| 017 | VRTB-D-M5_12212021 | Aqueous | PFPeS | PFAS by ID | 4.1 | | ng/L | 42 |
| 017 | VRTB-D-M5_12212021 | Aqueous | PFHxS | PFAS by ID | 80 | | ng/L | 42 |
| 017 | VRTB-D-M5_12212021 | Aqueous | PFBA | PFAS by ID | 5.8 | | ng/L | 42 |
| 017 | VRTB-D-M5_12212021 | Aqueous | PFHpA | PFAS by ID | 5.6 | | ng/L | 42 |
| 017 | VRTB-D-M5_12212021 | Aqueous | PFHxA | PFAS by ID | 12 | | ng/L | 42 |
| 017 | VRTB-D-M5_12212021 | Aqueous | PFNA | PFAS by ID | 1.1 | J | ng/L | 42 |
| 017 | VRTB-D-M5_12212021 | Aqueous | PFOA | PFAS by ID | 7.2 | | ng/L | 42 |
| 017 | VRTB-D-M5_12212021 | Aqueous | PFPeA | PFAS by ID | 13 | | ng/L | 42 |
| 017 | VRTB-D-M5_12212021 | Aqueous | PFOS | PFAS by ID | 170 | | ng/L | 42 |
| 018 | VRTB-D-06_12212021 | Aqueous | PFBS | PFAS by ID | 2.1 | J | ng/L | 44 |
| 018 | VRTB-D-06_12212021 | Aqueous | PFHpS | PFAS by ID | 6.7 | | ng/L | 44 |
| 018 | VRTB-D-06_12212021 | Aqueous | PFPeS | PFAS by ID | 3.7 | J | ng/L | 44 |
| 018 | VRTB-D-06_12212021 | Aqueous | PFHxS | PFAS by ID | 81 | | ng/L | 44 |
| 018 | VRTB-D-06_12212021 | Aqueous | PFBA | PFAS by ID | 6.2 | | ng/L | 44 |
| 018 | VRTB-D-06_12212021 | Aqueous | PFHpA | PFAS by ID | 5.9 | | ng/L | 44 |
| 018 | VRTB-D-06_12212021 | Aqueous | PFHxA | PFAS by ID | 13 | | ng/L | 44 |
| 018 | VRTB-D-06_12212021 | Aqueous | PFNA | PFAS by ID | 1.5 | J | ng/L | 44 |
| 018 | VRTB-D-06_12212021 | Aqueous | PFOA | PFAS by ID | 9.1 | | ng/L | 44 |
| 018 | VRTB-D-06_12212021 | Aqueous | PFPeA | PFAS by ID | 10 | | ng/L | 44 |
| 018 | VRTB-D-06_12212021 | Aqueous | PFOS | PFAS by ID | 310 | | ng/L | 44 |
| 019 | VRTB-D-R7_12212021 | Aqueous | PFBS | PFAS by ID | 1.2 | J | ng/L | 46 |
| 019 | VRTB-D-R7_12212021 | Aqueous | PFHpS | PFAS by ID | 1.6 | J | ng/L | 46 |
| 019 | VRTB-D-R7_12212021 | Aqueous | PFPeS | PFAS by ID | 2.0 | J | ng/L | 46 |
| 019 | VRTB-D-R7_12212021 | Aqueous | PFHxS | PFAS by ID | 41 | | ng/L | 46 |
| 019 | VRTB-D-R7_12212021 | Aqueous | PFBA | PFAS by ID | 5.5 | | ng/L | 46 |
| 019 | VRTB-D-R7_12212021 | Aqueous | PFHpA | PFAS by ID | 9.6 | | ng/L | 46 |
| 019 | VRTB-D-R7_12212021 | Aqueous | PFHxA | PFAS by ID | 10 | | ng/L | 46 |
| 019 | VRTB-D-R7_12212021 | Aqueous | PFNA | PFAS by ID | 2.4 | J | ng/L | 46 |
| 019 | VRTB-D-R7_12212021 | Aqueous | PFOA | PFAS by ID | 8.6 | | ng/L | 46 |
| 019 | VRTB-D-R7_12212021 | Aqueous | PFPeA | PFAS by ID | 11 | | ng/L | 46 |
| 019 | VRTB-D-R7_12212021 | Aqueous | PFOS | PFAS by ID | 120 | | ng/L | 46 |
| 020 | VRTB-D-P8_12212021 | Aqueous | PFBS | PFAS by ID | 4.8 | J | ng/L | 48 |
| 020 | VRTB-D-P8_12212021 | Aqueous | PFHpS | PFAS by ID | 3.4 | J | ng/L | 48 |
| 020 | VRTB-D-P8_12212021 | Aqueous | PFPeS | PFAS by ID | 3.3 | J | ng/L | 48 |
| 020 | VRTB-D-P8_12212021 | Aqueous | PFHxS | PFAS by ID | 93 | | ng/L | 48 |
| 020 | VRTB-D-P8_12212021 | Aqueous | PFBA | PFAS by ID | 16 | Q | ng/L | 48 |
| 020 | VRTB-D-P8_12212021 | Aqueous | PFHpA | PFAS by ID | 26 | | ng/L | 48 |
| 020 | VRTB-D-P8_12212021 | Aqueous | PFHxA | PFAS by ID | 25 | | ng/L | 48 |
| 020 | VRTB-D-P8_12212021 | Aqueous | PFNA | PFAS by ID | 6.3 | | ng/L | 48 |
| 020 | VRTB-D-P8_12212021 | Aqueous | PFOA | PFAS by ID | 20 | | ng/L | 48 |
| 020 | VRTB-D-P8_12212021 | Aqueous | PFPeA | PFAS by ID | 27 | | ng/L | 48 |
| 020 | VRTB-D-P8_12212021 | Aqueous | PFOS | PFAS by ID | 210 | | ng/L | 48 |

(230 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-001
Description: MW-VRTB-2S_12272021 | Matrix: Aqueous
Date Sampled: 12/27/2021 1509 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/13/2022 1544 | MMM | 01/12/2022 1730 | 28234 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 01/14/2022 1118 | MMM | 01/12/2022 1730 | 28234 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 9.5 | | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 20 | | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 14 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 31 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 33 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 770 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 49 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 110 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 140 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 31 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 84 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 130 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 9500 | | 81 | 41 | 20 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 101 | 50-150 | | 88 | 50-150 |
| 13C2_6:2FTS | | 120 | 50-150 | | 97 | 50-150 |
| 13C2_8:2FTS | | 118 | 50-150 | | 93 | 50-150 |
| 13C2_PFDoA | | 102 | 50-150 | | 104 | 50-150 |
| 13C2_PFTeDA | | 120 | 50-150 | | 96 | 50-150 |
| 13C3_PFBS | | 104 | 50-150 | | 102 | 50-150 |
| 13C3_PFHxS | | 101 | 50-150 | | 98 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 | | 99 | 50-150 |
| 13C4_PFHpA | | 96 | 50-150 | | 103 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 | | 97 | 50-150 |
| 13C5_PFPeA | | 101 | 50-150 | | 101 | 50-150 |
| 13C6_PFDA | | 112 | 50-150 | | 94 | 50-150 |
| 13C7_PFUdA | | 103 | 50-150 | | 99 | 50-150 |
| 13C8_PFOA | | 112 | 50-150 | | 102 | 50-150 |
| 13C8_PFOS | | 71 | 50-150 | | 94 | 50-150 |
| 13C8_PFOSA | | 112 | 50-150 | | 100 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WL30065-001
Description: MW-VRTB-2S_12272021
Matrix: Aqueous
Date Sampled: 12/27/2021 1509
Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021
Project Number: 30027244.00002

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 58 | 50-150 | | 99 | 50-150 |
| d5-EtFOSAA | | 123 | 50-150 | | 101 | 50-150 |
| d-MeFOSA | | 100 | 50-150 | | 94 | 50-150 |
| d3-MeFOSAA | | 113 | 50-150 | | 102 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-002
Description: MW-VRTB-2D_12272021 | Matrix: Aqueous
Date Sampled: 12/27/2021 1535 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/13/2022 1555 | MMM | 01/12/2022 1730 | 28234 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 14 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 13 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 19 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 290 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 15 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 10 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 21 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 36 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 17 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 240 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 107 | 50-150 |
| 13C2_6:2FTS | | 128 | 50-150 |
| 13C2_8:2FTS | | 117 | 50-150 |
| 13C2_PFDoA | | 105 | 50-150 |
| 13C2_PFTeDA | | 125 | 50-150 |
| 13C3_PFBS | | 109 | 50-150 |
| 13C3_PFHxS | | 109 | 50-150 |
| 13C4_PFBA | | 105 | 50-150 |
| 13C4_PFHpA | | 111 | 50-150 |
| 13C5_PFHxA | | 109 | 50-150 |
| 13C5_PFPeA | | 104 | 50-150 |
| 13C6_PFDA | | 116 | 50-150 |
| 13C7_PFUdA | | 110 | 50-150 |
| 13C8_PFOA | | 116 | 50-150 |
| 13C8_PFOS | | 109 | 50-150 |
| 13C8_PFOSA | | 116 | 50-150 |
| 13C9_PFNA | | 109 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL30065-002 |
| Description: MW-VRTB-2D_12272021 | | | Matrix: Aqueous |
| Date Sampled: 12/27/2021 1535 | | Project Name: ESTCP GAAF Vertebrae | |
| Date Received: 12/30/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 125 | 50-150 |
| d-MeFOSA | | 111 | 50-150 |
| d3-MeFOSAA | | 126 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-003
Description: MW-VRTB-3_12272021 | Matrix: Aqueous
Date Sampled: 12/27/2021 1639 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/13/2022 1606 | MMM | 01/12/2022 1730 | 28234 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.7 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.6 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.8 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 120 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 3.8 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 3.9 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 9.2 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.0 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 11 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 4.9 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 800 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 99 | 50-150 |
| 13C2_6:2FTS | | 118 | 50-150 |
| 13C2_8:2FTS | | 115 | 50-150 |
| 13C2_PFDoA | | 97 | 50-150 |
| 13C2_PFTeDA | | 120 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 |
| 13C3_PFHxS | | 99 | 50-150 |
| 13C4_PFBA | | 100 | 50-150 |
| 13C4_PFHpA | | 102 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 99 | 50-150 |
| 13C6_PFDA | | 113 | 50-150 |
| 13C7_PFUdA | | 105 | 50-150 |
| 13C8_PFOA | | 110 | 50-150 |
| 13C8_PFOS | | 101 | 50-150 |
| 13C8_PFOSA | | 111 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL30065-003 |
| Description: MW-VRTB-3_12272021 | | | Matrix: Aqueous |
| Date Sampled: 12/27/2021 1639 | | Project Name: ESTCP GAAF Vertebrae | |
| Date Received: 12/30/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 121 | 50-150 |
| d-MeFOSA | | 105 | 50-150 |
| d3-MeFOSAA | | 117 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-004
Description: Dup-02_12272021 | Matrix: Aqueous
Date Sampled: 12/27/2021 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/13/2022 1616 | MMM | 01/12/2022 1730 | 28234 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 01/15/2022 2204 | MMM | 01/12/2022 1730 | 28234 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 3.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.6 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.4 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.6 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 110 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 3.7 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 4.0 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 10 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.5 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 11 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 5.1 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 900 | | 20 | 10 | 4.9 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 | | 140 | 50-150 |
| 13C2_6:2FTS | | 120 | 50-150 | | 124 | 50-150 |
| 13C2_8:2FTS | | 116 | 50-150 | | 116 | 50-150 |
| 13C2_PFDoA | | 104 | 50-150 | | 116 | 50-150 |
| 13C2_PFTeDA | | 123 | 50-150 | | 120 | 50-150 |
| 13C3_PFBS | | 106 | 50-150 | | 118 | 50-150 |
| 13C3_PFHxS | | 106 | 50-150 | | 120 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 | | 120 | 50-150 |
| 13C4_PFHpA | | 107 | 50-150 | | 122 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 | | 117 | 50-150 |
| 13C5_PFPeA | | 104 | 50-150 | | 117 | 50-150 |
| 13C6_PFDA | | 118 | 50-150 | | 119 | 50-150 |
| 13C7_PFUdA | | 107 | 50-150 | | 116 | 50-150 |
| 13C8_PFOA | | 113 | 50-150 | | 118 | 50-150 |
| 13C8_PFOS | | 101 | 50-150 | | 116 | 50-150 |
| 13C8_PFOSA | | 113 | 50-150 | | 119 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WL30065-004
Description: Dup-02_12272021
Matrix: Aqueous
Date Sampled: 12/27/2021
Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021
Project Number: 30027244.00002

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 96 | 50-150 | | 118 | 50-150 |
| d5-EtFOSAA | | 126 | 50-150 | | 118 | 50-150 |
| d-MeFOSA | | 116 | 50-150 | | 111 | 50-150 |
| d3-MeFOSAA | | 124 | 50-150 | | 117 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-005
Description: VRTB-L-B1_12272021 | Matrix: Aqueous
Date Sampled: 12/27/2021 1242 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0405 | MMM | 01/13/2022 1107 | 28297 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 01/18/2022 1540 | MMM | 01/13/2022 1107 | 28297 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 6.6 | J | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 2.5 | J | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 5.3 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 12 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 9.3 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 150 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.1 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 7.3 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 15 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 11 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 26 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 10 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | UQ | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1200 | | 21 | 11 | 5.1 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 122 | 50-150 | | 131 | 50-150 |
| 13C2_6:2FTS | | 101 | 50-150 | | 125 | 50-150 |
| 13C2_8:2FTS | | 101 | 50-150 | | 120 | 50-150 |
| 13C2_PFDoA | | 73 | 50-150 | | 118 | 50-150 |
| 13C2_PFTeDA | N | 34 | 50-150 | | 106 | 50-150 |
| 13C3_PFBS | | 96 | 50-150 | | 122 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 | | 112 | 50-150 |
| 13C4_PFBA | | 90 | 50-150 | | 113 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 | | 110 | 50-150 |
| 13C5_PFHxA | | 100 | 50-150 | | 116 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 | | 115 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 | | 118 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 | | 109 | 50-150 |
| 13C8_PFOA | | 94 | 50-150 | | 110 | 50-150 |
| 13C8_PFOS | | 82 | 50-150 | | 125 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 | | 126 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WL30065-005
Description: VRTB-L-B1_12272021
Matrix: Aqueous
Date Sampled: 12/27/2021 1242
Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021
Project Number: 30027244.00002

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 73 | 50-150 | | 112 | 50-150 |
| d5-EtFOSAA | | 89 | 50-150 | | 126 | 50-150 |
| d-MeFOSA | | 88 | 50-150 | | 121 | 50-150 |
| d3-MeFOSAA | | 100 | 50-150 | | 125 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-006
Description: VRTB-L-S2_12272021 | Matrix: Aqueous
Date Sampled: 12/27/2021 1147 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0415 | MMM | 01/13/2022 1107 | 28297 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.8 | J | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 10 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 10 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 14 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 190 | S | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 9.4 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 8.8 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 18 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.7 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 32 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 14 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | UQ | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | US | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 430 | S | 4.1 | 2.1 | 1.0 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 109 | 50-150 |
| 13C2_6:2FTS | | 117 | 50-150 |
| 13C2_8:2FTS | | 109 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 |
| 13C2_PFTeDA | N | 39 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 102 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 |
| 13C5_PFHxA | | 98 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 94 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 |
| 13C8_PFOA | | 98 | 50-150 |
| 13C8_PFOS | | 94 | 50-150 |
| 13C8_PFOSA | | 98 | 50-150 |
| 13C9_PFNA | | 84 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL30065-006 |
| Description: VRTB-L-S2_12272021 | | | Matrix: Aqueous |
| Date Sampled: 12/27/2021 1147 | | Project Name: ESTCP GAAF Vertebrae | |
| Date Received: 12/30/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 95 | 50-150 |
| d-MeFOSA | | 70 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-007
Description: VRTB-L-Y3_12272021 | Matrix: Aqueous
Date Sampled: 12/27/2021 1148 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0458 | MMM | 01/13/2022 1107 | 28297 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 15 | | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 5.5 | J | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 5.4 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 9.1 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 7.9 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 130 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 14 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 11 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 18 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 3.7 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 23 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 14 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | UQ | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 720 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 113 | 50-150 |
| 13C2_6:2FTS | | 114 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 |
| 13C2_PFDoA | | 75 | 50-150 |
| 13C2_PFTeDA | N | 41 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 96 | 50-150 |
| 13C5_PFHxA | | 96 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 |
| 13C6_PFDA | | 97 | 50-150 |
| 13C7_PFUdA | | 90 | 50-150 |
| 13C8_PFOA | | 100 | 50-150 |
| 13C8_PFOS | | 89 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 |
| 13C9_PFNA | | 86 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL30065-007 |
| Description: VRTB-L-Y3_12272021 | | | Matrix: Aqueous |
| Date Sampled: 12/27/2021 1148 | | Project Name: ESTCP GAAF Vertebrae | |
| Date Received: 12/30/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 74 | 50-150 |
| d3-MeFOSAA | | 93 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-008
Description: VRTB-L-G4_12272021 | Matrix: Aqueous
Date Sampled: 12/27/2021 1100 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0519 | MMM | 01/13/2022 1107 | 28297 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 01/18/2022 1633 | MMM | 01/13/2022 1107 | 28297 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 19 | | 7.8 | 3.9 | 1.9 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 7.8 | | 7.8 | 3.9 | 1.9 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 1.9 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 1.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 3.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 1.9 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 8.2 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 10 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 11 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 160 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 13 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 15 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 21 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 5.4 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 28 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 20 | | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | UQ | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.97 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1000 | | 19 | 9.5 | 4.8 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 102 | 50-150 | | 125 | 50-150 |
| 13C2_6:2FTS | | 105 | 50-150 | | 125 | 50-150 |
| 13C2_8:2FTS | | 104 | 50-150 | | 146 | 50-150 |
| 13C2_PFDoA | | 78 | 50-150 | | 128 | 50-150 |
| 13C2_PFTeDA | N | 41 | 50-150 | | 105 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 | | 127 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 | | 117 | 50-150 |
| 13C4_PFBA | | 101 | 50-150 | | 117 | 50-150 |
| 13C4_PFHpA | | 103 | 50-150 | | 111 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 | | 113 | 50-150 |
| 13C5_PFPeA | | 95 | 50-150 | | 116 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 | | 118 | 50-150 |
| 13C7_PFUdA | | 97 | 50-150 | | 117 | 50-150 |
| 13C8_PFOA | | 100 | 50-150 | | 111 | 50-150 |
| 13C8_PFOS | | 94 | 50-150 | | 128 | 50-150 |
| 13C8_PFOSA | | 98 | 50-150 | | 125 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WL30065-008
Description: VRTB-L-G4_12272021
Matrix: Aqueous
Date Sampled: 12/27/2021 1100
Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021
Project Number: 30027244.00002

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 87 | 50-150 | | 118 | 50-150 |
| d5-EtFOSAA | | 91 | 50-150 | | 132 | 50-150 |
| d-MeFOSA | | 80 | 50-150 | | 105 | 50-150 |
| d3-MeFOSAA | | 97 | 50-150 | | 126 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-009
Description: VRTB-L-M5_12232021 | Matrix: Aqueous
Date Sampled: 12/23/2021 1515 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/18/2022 1716 | MMM | 01/13/2022 1107 | 28297 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 01/18/2022 1705 | MMM | 01/13/2022 1107 | 28297 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 72 | J | 80 | 40 | 20 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 82 | | 80 | 40 | 20 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 80 | U | 160 | 80 | 40 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 36 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 10 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 620 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 24 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 85 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 80 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 50 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 110 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 83 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 11000 | | 200 | 100 | 50 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 116 | 50-150 | | 124 | 50-150 |
| 13C2_6:2FTS | | 112 | 50-150 | | 116 | 50-150 |
| 13C2_8:2FTS | | 113 | 50-150 | | 135 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 | | 111 | 50-150 |
| 13C2_PFTeDA | | 51 | 50-150 | | 98 | 50-150 |
| 13C3_PFBS | | 112 | 50-150 | | 114 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 | | 104 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 | | 106 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 | | 98 | 50-150 |
| 13C5_PFHxA | | 103 | 50-150 | | 113 | 50-150 |
| 13C5_PFPeA | | 104 | 50-150 | | 105 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 | | 107 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 | | 104 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 | | 102 | 50-150 |
| 13C8_PFOS | | 97 | 50-150 | | 115 | 50-150 |
| 13C8_PFOSA | | 107 | 50-150 | | 115 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WL30065-009
Description: VRTB-L-M5_12232021
Matrix: Aqueous
Date Sampled: 12/23/2021 1515
Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021
Project Number: 30027244.00002

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | | 105 | 50-150 |
| d5-EtFOSAA | | 89 | 50-150 | | 116 | 50-150 |
| d-MeFOSA | | 58 | 50-150 | | 101 | 50-150 |
| d3-MeFOSAA | | 105 | 50-150 | | 114 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-010
Description: VRTB-L-06_12232021 | Matrix: Aqueous
Date Sampled: 12/23/2021 1653 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0540 | MMM | 01/13/2022 1107 | 28297 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 100 | U | 200 | 100 | 50 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 110 | J | 200 | 100 | 50 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 100 | U | 200 | 100 | 50 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 100 | U | 200 | 100 | 50 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 100 | U | 200 | 100 | 50 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 50 | U | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 50 | U | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 61 | J | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 50 | U | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 50 | U | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 50 | U | 100 | 50 | 25 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1100 | | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 50 | U | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 50 | U | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 50 | U | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 130 | | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 110 | | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 63 | J | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 200 | | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 120 | | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 50 | U | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 50 | U | 100 | 50 | 25 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 50 | U | 100 | 50 | 25 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 13000 | | 100 | 50 | 25 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 103 | 50-150 |
| 13C2_8:2FTS | | 95 | 50-150 |
| 13C2_PFDoA | | 78 | 50-150 |
| 13C2_PFTeDA | | 70 | 50-150 |
| 13C3_PFBS | | 88 | 50-150 |
| 13C3_PFHxS | | 84 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 |
| 13C4_PFHpA | | 91 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 |
| 13C5_PFPeA | | 87 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 |
| 13C8_PFOS | | 84 | 50-150 |
| 13C8_PFOSA | | 87 | 50-150 |
| 13C9_PFNA | | 85 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL30065-010 |
| Description: VRTB-L-06_12232021 | | | Matrix: Aqueous |
| Date Sampled: 12/23/2021 1653 | | Project Name: ESTCP GAAF Vertebrae | |
| Date Received: 12/30/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 87 | 50-150 |
| d-MeFOSA | | 67 | 50-150 |
| d3-MeFOSAA | | 86 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-011
Description: VRTB-L-P7_12232021 | Matrix: Aqueous
Date Sampled: 12/23/2021 1638 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0551 | MMM | 01/13/2022 1107 | 28297 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 01/18/2022 1737 | MMM | 01/13/2022 1107 | 28297 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 29 | J | 80 | 40 | 20 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 60 | J | 80 | 40 | 20 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 80 | U | 160 | 80 | 40 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 40 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 15 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 820 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 23 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 96 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 90 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 39 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 110 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 74 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 10000 | | 200 | 100 | 50 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 98 | 50-150 | | 126 | 50-150 |
| 13C2_6:2FTS | | 108 | 50-150 | | 133 | 50-150 |
| 13C2_8:2FTS | | 97 | 50-150 | | 134 | 50-150 |
| 13C2_PFDoA | | 66 | 50-150 | | 117 | 50-150 |
| 13C2_PFTeDA | | 52 | 50-150 | | 112 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 | | 128 | 50-150 |
| 13C3_PFHxS | | 89 | 50-150 | | 115 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 | | 115 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 | | 106 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 | | 115 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 | | 116 | 50-150 |
| 13C6_PFDA | | 92 | 50-150 | | 123 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 | | 113 | 50-150 |
| 13C8_PFOA | | 95 | 50-150 | | 111 | 50-150 |
| 13C8_PFOS | | 81 | 50-150 | | 124 | 50-150 |
| 13C8_PFOSA | | 88 | 50-150 | | 128 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WL30065-011
Description: VRTB-L-P7_12232021
Matrix: Aqueous
Date Sampled: 12/23/2021 1638
Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021
Project Number: 30027244.00002

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 79 | 50-150 | | 115 | 50-150 |
| d5-EtFOSAA | | 75 | 50-150 | | 127 | 50-150 |
| d-MeFOSA | | 54 | 50-150 | | 107 | 50-150 |
| d3-MeFOSAA | | 81 | 50-150 | | 133 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-012
Description: VRTB-L-BB8_12272021 | Matrix: Aqueous
Date Sampled: 12/27/2021 1355 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0601 | MMM | 01/13/2022 1107 | 28297 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 28 | J | 80 | 40 | 20 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 80 | U | 160 | 80 | 40 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 11 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 38 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 23 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 740 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 26 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 68 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 93 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 34 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 73 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 68 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 7900 | | 40 | 20 | 10 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 |
| 13C2_6:2FTS | | 132 | 50-150 |
| 13C2_8:2FTS | | 107 | 50-150 |
| 13C2_PFDoA | | 94 | 50-150 |
| 13C2_PFTeDA | | 83 | 50-150 |
| 13C3_PFBS | | 102 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 |
| 13C4_PFBA | | 104 | 50-150 |
| 13C4_PFHpA | | 104 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 103 | 50-150 |
| 13C6_PFDA | | 103 | 50-150 |
| 13C7_PFUdA | | 102 | 50-150 |
| 13C8_PFOA | | 105 | 50-150 |
| 13C8_PFOS | | 92 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 |
| 13C9_PFNA | | 92 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL30065-012 |
| Description: VRTB-L-BB8_12272021 | | | Matrix: Aqueous |
| Date Sampled: 12/27/2021 1355 | | Project Name: ESTCP GAAF Vertebrae | |
| Date Received: 12/30/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 98 | 50-150 |
| d-MeFOSA | | 68 | 50-150 |
| d3-MeFOSAA | | 107 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-013
Description: VRTB-S-B1_12232021 | Matrix: Aqueous
Date Sampled: 12/23/2021 1318 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0054 | MMM | 01/14/2022 1732 | 28521 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.4 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.0 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.1 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 17 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 1.5 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 2.5 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 2.5 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 2.7 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 180 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 124 | 50-150 |
| 13C2_6:2FTS | | 113 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 |
| 13C2_PFTeDA | | 76 | 50-150 |
| 13C3_PFBS | | 110 | 50-150 |
| 13C3_PFHxS | | 101 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 |
| 13C4_PFHpA | | 101 | 50-150 |
| 13C5_PFHxA | | 107 | 50-150 |
| 13C5_PFPeA | | 98 | 50-150 |
| 13C6_PFDA | | 102 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 |
| 13C8_PFOS | | 97 | 50-150 |
| 13C8_PFOSA | | 104 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: WL30065-013 | |
| Description: VRTB-S-B1_12232021 | | Matrix: Aqueous | |
| Date Sampled: 12/23/2021 1318 | Project Name: ESTCP GAAF Vertebrae | | |
| Date Received: 12/30/2021 | Project Number: 30027244.00002 | | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 97 | 50-150 |
| d-MeFOSA | | 79 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-014
Description: VRTB-S-S2_12232021 | Matrix: Aqueous
Date Sampled: 12/23/2021 1145 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0104 | MMM | 01/14/2022 1732 | 28521 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 01/18/2022 1519 | MMM | 01/14/2022 1732 | 28521 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 6.5 | J | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 8.1 | J | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.2 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.2 | | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.8 | | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 7.3 | | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 200 | | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 11 | | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 33 | | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 26 | | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 8.0 | | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 26 | | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 19 | | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1000 | | 21 | 11 | 5.2 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 | | 124 | 50-150 |
| 13C2_6:2FTS | | 115 | 50-150 | | 136 | 50-150 |
| 13C2_8:2FTS | | 94 | 50-150 | | 129 | 50-150 |
| 13C2_PFDoA | | 84 | 50-150 | | 118 | 50-150 |
| 13C2_PFTeDA | | 72 | 50-150 | | 114 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 | | 123 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 | | 114 | 50-150 |
| 13C4_PFBA | | 99 | 50-150 | | 115 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 | | 108 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 | | 110 | 50-150 |
| 13C5_PFPeA | | 98 | 50-150 | | 117 | 50-150 |
| 13C6_PFDA | | 92 | 50-150 | | 118 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 | | 118 | 50-150 |
| 13C8_PFOA | | 98 | 50-150 | | 116 | 50-150 |
| 13C8_PFOS | | 84 | 50-150 | | 118 | 50-150 |
| 13C8_PFOSA | | 93 | 50-150 | | 118 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WL30065-014
Description: VRTB-S-S2_12232021
Matrix: Aqueous
Date Sampled: 12/23/2021 1145
Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021
Project Number: 30027244.00002

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 85 | 50-150 | | 112 | 50-150 |
| d5-EtFOSAA | | 97 | 50-150 | | 128 | 50-150 |
| d-MeFOSA | | 74 | 50-150 | | 119 | 50-150 |
| d3-MeFOSAA | | 95 | 50-150 | | 129 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-015
Description: VRTB-S-Y3_12232021 | Matrix: Aqueous
Date Sampled: 12/23/2021 1227 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0115 | MMM | 01/14/2022 1732 | 28521 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 01/18/2022 1530 | MMM | 01/14/2022 1732 | 28521 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 6.5 | J | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 10 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 20 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 27 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 490 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 8.4 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 15 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 31 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 4.5 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 15 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1500 | | 20 | 10 | 4.9 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 116 | 50-150 | | 130 | 50-150 |
| 13C2_6:2FTS | | 118 | 50-150 | | 128 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 | | 135 | 50-150 |
| 13C2_PFDoA | | 84 | 50-150 | | 124 | 50-150 |
| 13C2_PFTeDA | | 62 | 50-150 | | 109 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 | | 124 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 | | 106 | 50-150 |
| 13C4_PFBA | | 99 | 50-150 | | 112 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 | | 104 | 50-150 |
| 13C5_PFHxA | | 102 | 50-150 | | 116 | 50-150 |
| 13C5_PFPeA | | 99 | 50-150 | | 116 | 50-150 |
| 13C6_PFDA | | 99 | 50-150 | | 116 | 50-150 |
| 13C7_PFUdA | | 92 | 50-150 | | 119 | 50-150 |
| 13C8_PFOA | | 96 | 50-150 | | 110 | 50-150 |
| 13C8_PFOS | | 86 | 50-150 | | 125 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 | | 118 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WL30065-015
Description: VRTB-S-Y3_12232021
Matrix: Aqueous
Date Sampled: 12/23/2021 1227
Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021
Project Number: 30027244.00002

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 76 | 50-150 | | 101 | 50-150 |
| d5-EtFOSAA | | 100 | 50-150 | | 128 | 50-150 |
| d-MeFOSA | | 84 | 50-150 | | 113 | 50-150 |
| d3-MeFOSAA | | 100 | 50-150 | | 128 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-016
Description: VRTB-S-G4_12232021 | Matrix: Aqueous
Date Sampled: 12/23/2021 1125 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0125 | MMM | 01/14/2022 1732 | 28521 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 6.8 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.5 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 8.7 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 160 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 2.7 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 2.5 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 3.4 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.5 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 4.5 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 1.6 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 570 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 117 | 50-150 |
| 13C2_6:2FTS | | 114 | 50-150 |
| 13C2_8:2FTS | | 100 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 |
| 13C2_PFTeDA | | 85 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 |
| 13C3_PFHxS | | 98 | 50-150 |
| 13C4_PFBA | | 102 | 50-150 |
| 13C4_PFHpA | | 101 | 50-150 |
| 13C5_PFHxA | | 106 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 99 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 106 | 50-150 |
| 13C8_PFOS | | 102 | 50-150 |
| 13C8_PFOSA | | 106 | 50-150 |
| 13C9_PFNA | | 92 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL30065-016 |
| Description: VRTB-S-G4_12232021 | | | Matrix: Aqueous |
| Date Sampled: 12/23/2021 1125 | | Project Name: ESTCP GAAF Vertebrae | |
| Date Received: 12/30/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 100 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 103 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-017
Description: VRTB-D-M5_12212021 | Matrix: Aqueous
Date Sampled: 12/21/2021 1605 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0136 | MMM | 01/14/2022 1732 | 28521 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 3.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.9 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 4.8 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 4.1 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 80 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 5.8 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 5.6 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 12 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.1 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 7.2 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 13 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 170 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 117 | 50-150 |
| 13C2_8:2FTS | | 93 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 55 | 50-150 |
| 13C3_PFBS | | 96 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 94 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 |
| 13C7_PFUdA | | 81 | 50-150 |
| 13C8_PFOA | | 95 | 50-150 |
| 13C8_PFOS | | 89 | 50-150 |
| 13C8_PFOSA | | 99 | 50-150 |
| 13C9_PFNA | | 90 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL30065-017 |
| Description: VRTB-D-M5_12212021 | | | Matrix: Aqueous |
| Date Sampled: 12/21/2021 1605 | Project Name: ESTCP GAAF Vertebrae | | |
| Date Received: 12/30/2021 | Project Number: 30027244.00002 | | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 92 | 50-150 |
| d-MeFOSA | | 74 | 50-150 |
| d3-MeFOSAA | | 99 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-018
Description: VRTB-D-06_12212021 | Matrix: Aqueous
Date Sampled: 12/21/2021 1421 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0147 | MMM | 01/14/2022 1732 | 28521 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.1 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 6.7 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 3.7 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 81 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.2 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 5.9 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 13 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.5 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 9.1 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 10 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 310 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 112 | 50-150 |
| 13C2_6:2FTS | | 126 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 |
| 13C2_PFTeDA | | 60 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 |
| 13C3_PFHxS | | 101 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 |
| 13C4_PFHpA | | 104 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 99 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 |
| 13C7_PFUdA | | 99 | 50-150 |
| 13C8_PFOA | | 101 | 50-150 |
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 |
| 13C9_PFNA | | 96 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL30065-018 |
| Description: VRTB-D-06_12212021 | | | Matrix: Aqueous |
| Date Sampled: 12/21/2021 1421 | | Project Name: ESTCP GAAF Vertebrae | |
| Date Received: 12/30/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 104 | 50-150 |
| d-MeFOSA | | 75 | 50-150 |
| d3-MeFOSAA | | 99 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-019
Description: VRTB-D-R7_12212021 | Matrix: Aqueous
Date Sampled: 12/21/2021 1545 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0219 | MMM | 01/14/2022 1732 | 28521 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 3.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.2 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.6 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.0 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 41 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 5.5 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 9.6 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 10 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.4 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 8.6 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 11 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 120 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 126 | 50-150 |
| 13C2_6:2FTS | | 124 | 50-150 |
| 13C2_8:2FTS | | 101 | 50-150 |
| 13C2_PFDoA | | 83 | 50-150 |
| 13C2_PFTeDA | | 58 | 50-150 |
| 13C3_PFBS | | 103 | 50-150 |
| 13C3_PFHxS | | 101 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 |
| 13C4_PFHpA | | 102 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 |
| 13C6_PFDA | | 97 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 |
| 13C8_PFOA | | 108 | 50-150 |
| 13C8_PFOS | | 99 | 50-150 |
| 13C8_PFOSA | | 104 | 50-150 |
| 13C9_PFNA | | 102 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL30065-019 |
| Description: VRTB-D-R7_12212021 | | | Matrix: Aqueous |
| Date Sampled: 12/21/2021 1545 | | Project Name: ESTCP GAAF Vertebrae | |
| Date Received: 12/30/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 98 | 50-150 |
| d-MeFOSA | | 78 | 50-150 |
| d3-MeFOSAA | | 106 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WL30065-020
Description: VRTB-D-P8_12212021 | Matrix: Aqueous
Date Sampled: 12/21/2021 1424 | Project Name: ESTCP GAAF Vertebrae
Date Received: 12/30/2021 | Project Number: 30027244.00002

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 01/16/2022 0229 | MMM | 01/14/2022 1732 | 28521 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.9 | U | 9.8 | 4.9 | 2.5 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.9 | U | 9.8 | 4.9 | 2.5 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.9 | U | 9.8 | 4.9 | 2.5 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.9 | U | 9.8 | 4.9 | 2.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 10 | U | 20 | 10 | 4.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.9 | U | 9.8 | 4.9 | 2.5 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.8 | J | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.5 | U | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 3.4 | J | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.5 | U | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.5 | U | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 3.3 | J | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 93 | | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 16 | Q | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.5 | U | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.5 | U | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 26 | | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 25 | | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 6.3 | | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 20 | | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 27 | | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.5 | U | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.5 | U | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.5 | U | 4.9 | 2.5 | 1.2 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 210 | | 4.9 | 2.5 | 1.2 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 99 | 50-150 |
| 13C2_8:2FTS | | 81 | 50-150 |
| 13C2_PFDoA | | 70 | 50-150 |
| 13C2_PFTeDA | | 56 | 50-150 |
| 13C3_PFBS | | 80 | 50-150 |
| 13C3_PFHxS | | 75 | 50-150 |
| 13C4_PFBA | N | 48 | 50-150 |
| 13C4_PFHpA | | 83 | 50-150 |
| 13C5_PFHxA | | 82 | 50-150 |
| 13C5_PFPeA | | 79 | 50-150 |
| 13C6_PFDA | | 80 | 50-150 |
| 13C7_PFUdA | | 73 | 50-150 |
| 13C8_PFOA | | 83 | 50-150 |
| 13C8_PFOS | | 83 | 50-150 |
| 13C8_PFOSA | | 82 | 50-150 |
| 13C9_PFNA | | 80 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: WL30065-020 |
| Description: VRTB-D-P8_12212021 | | | Matrix: Aqueous |
| Date Sampled: 12/21/2021 1424 | | Project Name: ESTCP GAAF Vertebrae | |
| Date Received: 12/30/2021 | | Project Number: 30027244.00002 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 76 | 50-150 |
| d-MeFOSA | | 74 | 50-150 |
| d3-MeFOSAA | | 74 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: XQ28234-001
Batch: 28234
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/12/2022 1730

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/13/2022 1502 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/13/2022 1502 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/13/2022 1502 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/13/2022 1502 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 01/13/2022 1502 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/13/2022 1502 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/13/2022 1502 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 104 | 50-150 |
| 13C2_6:2FTS | | 118 | 50-150 |
| 13C2_8:2FTS | | 116 | 50-150 |
| 13C2_PFDoA | | 101 | 50-150 |
| 13C2_PFTeDA | | 119 | 50-150 |
| 13C3_PFBS | | 105 | 50-150 |
| 13C3_PFHxS | | 103 | 50-150 |
| 13C4_PFBA | | 105 | 50-150 |
| 13C4_PFHpA | | 104 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 108 | 50-150 |
| 13C7_PFUdA | | 104 | 50-150 |
| 13C8_PFOA | | 110 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ28234-001
Batch: 28234
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/12/2022 1730

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 103 | 50-150 |
| 13C8_PFOSA | | 104 | 50-150 |
| 13C9_PFNA | | 105 | 50-150 |
| d5-EtFOSAA | | 115 | 50-150 |
| d-MeFOSA | | 104 | 50-150 |
| d3-MeFOSAA | | 115 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ28234-002
Batch: 28234
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/12/2022 1730

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 14 | | 1 | 94 | 67-138 | 01/13/2022 1513 |
| 6:2 FTS | 15 | 13 | | 1 | 87 | 64-140 | 01/13/2022 1513 |
| 4:2 FTS | 15 | 15 | | 1 | 100 | 63-143 | 01/13/2022 1513 |
| EtFOSAA | 16 | 16 | | 1 | 99 | 61-135 | 01/13/2022 1513 |
| MeFOSA | 16 | 16 | | 1 | 103 | 68-141 | 01/13/2022 1513 |
| MeFOSAA | 16 | 12 | | 1 | 74 | 65-136 | 01/13/2022 1513 |
| PFBS | 14 | 14 | | 1 | 96 | 72-130 | 01/13/2022 1513 |
| PFDS | 15 | 14 | | 1 | 90 | 53-142 | 01/13/2022 1513 |
| PFHpS | 15 | 15 | | 1 | 98 | 69-134 | 01/13/2022 1513 |
| PFNS | 15 | 15 | | 1 | 99 | 69-127 | 01/13/2022 1513 |
| PFOSA | 16 | 14 | | 1 | 88 | 67-137 | 01/13/2022 1513 |
| PFPeS | 15 | 15 | | 1 | 101 | 71-127 | 01/13/2022 1513 |
| PFHxS | 15 | 14 | | 1 | 98 | 68-131 | 01/13/2022 1513 |
| PFBA | 16 | 15 | | 1 | 92 | 73-129 | 01/13/2022 1513 |
| PFDA | 16 | 16 | | 1 | 98 | 71-129 | 01/13/2022 1513 |
| PFDoA | 16 | 15 | | 1 | 93 | 72-134 | 01/13/2022 1513 |
| PFHpA | 16 | 15 | | 1 | 94 | 72-130 | 01/13/2022 1513 |
| PFHxA | 16 | 14 | | 1 | 87 | 72-129 | 01/13/2022 1513 |
| PFNA | 16 | 16 | | 1 | 97 | 69-130 | 01/13/2022 1513 |
| PFOA | 16 | 15 | | 1 | 91 | 71-133 | 01/13/2022 1513 |
| PFPeA | 16 | 15 | | 1 | 91 | 72-129 | 01/13/2022 1513 |
| PFTeDA | 16 | 15 | | 1 | 92 | 71-132 | 01/13/2022 1513 |
| PFTrDA | 16 | 16 | | 1 | 99 | 65-144 | 01/13/2022 1513 |
| PFUdA | 16 | 14 | | 1 | 86 | 69-133 | 01/13/2022 1513 |
| PFOS | 15 | 15 | | 1 | 103 | 65-140 | 01/13/2022 1513 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 |
| 13C2_6:2FTS | | 118 | 50-150 |
| 13C2_8:2FTS | | 118 | 50-150 |
| 13C2_PFDoA | | 101 | 50-150 |
| 13C2_PFTeDA | | 121 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 |
| 13C4_PFBA | | 102 | 50-150 |
| 13C4_PFHpA | | 105 | 50-150 |
| 13C5_PFHxA | | 106 | 50-150 |
| 13C5_PFPeA | | 101 | 50-150 |
| 13C6_PFDA | | 113 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 110 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ28234-002
Batch: 28234
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/12/2022 1730

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 101 | 50-150 |
| 13C8_PFOSA | | 104 | 50-150 |
| 13C9_PFNA | | 104 | 50-150 |
| d5-EtFOSAA | | 111 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 122 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ28297-001
Batch: 28297
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/13/2022 1107

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/14/2022 1407 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/14/2022 1407 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/14/2022 1407 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/14/2022 1407 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 01/14/2022 1407 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/14/2022 1407 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/14/2022 1407 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 95 | 50-150 |
| 13C2_6:2FTS | | 108 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 |
| 13C2_PFDoA | | 93 | 50-150 |
| 13C2_PFTeDA | | 77 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 99 | 50-150 |
| 13C4_PFHpA | | 104 | 50-150 |
| 13C5_PFHxA | | 97 | 50-150 |
| 13C5_PFPeA | | 101 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 |
| 13C8_PFOA | | 98 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ28297-001
Batch: 28297
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/13/2022 1107

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 92 | 50-150 |
| 13C8_PFOSA | | 94 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d5-EtFOSAA | | 104 | 50-150 |
| d-MeFOSA | | 77 | 50-150 |
| d3-MeFOSAA | | 112 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ28297-002
Batch: 28297
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/13/2022 1107

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 14 | | 1 | 93 | 67-138 | 01/14/2022 1418 |
| 6:2 FTS | 15 | 14 | | 1 | 94 | 64-140 | 01/14/2022 1418 |
| 4:2 FTS | 15 | 15 | | 1 | 99 | 63-143 | 01/14/2022 1418 |
| EtFOSAA | 16 | 15 | | 1 | 96 | 61-135 | 01/14/2022 1418 |
| MeFOSA | 16 | 18 | | 1 | 114 | 68-141 | 01/14/2022 1418 |
| MeFOSAA | 16 | 17 | | 1 | 105 | 65-136 | 01/14/2022 1418 |
| PFBS | 14 | 14 | | 1 | 97 | 72-130 | 01/14/2022 1418 |
| PFDS | 15 | 15 | | 1 | 96 | 53-142 | 01/14/2022 1418 |
| PFHpS | 15 | 14 | | 1 | 93 | 69-134 | 01/14/2022 1418 |
| PFNS | 15 | 16 | | 1 | 106 | 69-127 | 01/14/2022 1418 |
| PFOSA | 16 | 16 | | 1 | 102 | 67-137 | 01/14/2022 1418 |
| PFPeS | 15 | 16 | | 1 | 105 | 71-127 | 01/14/2022 1418 |
| PFHxS | 15 | 14 | | 1 | 98 | 68-131 | 01/14/2022 1418 |
| PFBA | 16 | 15 | | 1 | 96 | 73-129 | 01/14/2022 1418 |
| PFDA | 16 | 16 | | 1 | 100 | 71-129 | 01/14/2022 1418 |
| PFDoA | 16 | 16 | | 1 | 100 | 72-134 | 01/14/2022 1418 |
| PFHpA | 16 | 17 | | 1 | 105 | 72-130 | 01/14/2022 1418 |
| PFHxA | 16 | 16 | | 1 | 97 | 72-129 | 01/14/2022 1418 |
| PFNA | 16 | 15 | | 1 | 97 | 69-130 | 01/14/2022 1418 |
| PFOA | 16 | 14 | | 1 | 87 | 71-133 | 01/14/2022 1418 |
| PFPeA | 16 | 16 | | 1 | 100 | 72-129 | 01/14/2022 1418 |
| PFTeDA | 16 | 17 | | 1 | 105 | 71-132 | 01/14/2022 1418 |
| PFTrDA | 16 | 15 | | 1 | 95 | 65-144 | 01/14/2022 1418 |
| PFUdA | 16 | 17 | | 1 | 106 | 69-133 | 01/14/2022 1418 |
| PFOS | 15 | 14 | | 1 | 96 | 65-140 | 01/14/2022 1418 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 90 | 50-150 |
| 13C2_6:2FTS | | 110 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 |
| 13C2_PFDoA | | 86 | 50-150 |
| 13C2_PFTeDA | | 78 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 |
| 13C3_PFHxS | | 99 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 |
| 13C5_PFPeA | | 99 | 50-150 |
| 13C6_PFDA | | 97 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ28297-002
Batch: 28297
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/13/2022 1107

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 98 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 |
| d-MeFOSA | | 90 | 50-150 |
| d3-MeFOSAA | | 106 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: WL30065-006MS
Batch: 28297
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/13/2022 1107

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 3.8 | 15 | 20 | | 1 | 104 | 67-138 | 01/16/2022 0426 |
| 6:2 FTS | ND | 15 | 17 | | 1 | 111 | 64-140 | 01/16/2022 0426 |
| 4:2 FTS | ND | 15 | 14 | | 1 | 93 | 63-143 | 01/16/2022 0426 |
| EtFOSAA | ND | 16 | 14 | | 1 | 88 | 61-135 | 01/16/2022 0426 |
| MeFOSA | ND | 16 | 18 | | 1 | 110 | 68-141 | 01/16/2022 0426 |
| MeFOSAA | ND | 16 | 16 | | 1 | 101 | 65-136 | 01/16/2022 0426 |
| PFBS | 10 | 14 | 24 | | 1 | 93 | 72-130 | 01/16/2022 0426 |
| PFDS | ND | 15 | 14 | | 1 | 90 | 53-142 | 01/16/2022 0426 |
| PFHpS | 10 | 15 | 25 | | 1 | 96 | 69-134 | 01/16/2022 0426 |
| PFNS | ND | 15 | 17 | | 1 | 109 | 69-127 | 01/16/2022 0426 |
| PFOSA | ND | 16 | 15 | | 1 | 96 | 67-137 | 01/16/2022 0426 |
| PFPeS | 14 | 15 | 30 | | 1 | 109 | 71-127 | 01/16/2022 0426 |
| PFHxS | 190 | 15 | 200 | N | 1 | 63 | 68-131 | 01/16/2022 0426 |
| PFBA | 9.4 | 16 | 25 | | 1 | 97 | 73-129 | 01/16/2022 0426 |
| PFDA | ND | 16 | 16 | | 1 | 98 | 71-129 | 01/16/2022 0426 |
| PFDoA | ND | 16 | 16 | | 1 | 100 | 72-134 | 01/16/2022 0426 |
| PFHpA | 8.8 | 16 | 24 | | 1 | 95 | 72-130 | 01/16/2022 0426 |
| PFHxA | 18 | 16 | 35 | | 1 | 103 | 72-129 | 01/16/2022 0426 |
| PFNA | 2.7 | 16 | 18 | | 1 | 98 | 69-130 | 01/16/2022 0426 |
| PFOA | 32 | 16 | 46 | | 1 | 86 | 71-133 | 01/16/2022 0426 |
| PFPeA | 14 | 16 | 31 | | 1 | 105 | 72-129 | 01/16/2022 0426 |
| PFTeDA | ND | 16 | 16 | | 1 | 98 | 71-132 | 01/16/2022 0426 |
| PFTrDA | ND | 16 | 9.5 | N | 1 | 59 | 65-144 | 01/16/2022 0426 |
| PFUdA | ND | 16 | 16 | | 1 | 100 | 69-133 | 01/16/2022 0426 |
| PFOS | 430 | 15 | 480 | N | 1 | 306 | 65-140 | 01/16/2022 0426 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 113 | 50-150 |
| 13C2_6:2FTS | | 102 | 50-150 |
| 13C2_8:2FTS | | 97 | 50-150 |
| 13C2_PFDoA | | 70 | 50-150 |
| 13C2_PFTeDA | N | 36 | 50-150 |
| 13C3_PFBS | | 92 | 50-150 |
| 13C3_PFHxS | | 90 | 50-150 |
| 13C4_PFBA | | 94 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 |
| 13C5_PFHxA | | 88 | 50-150 |
| 13C5_PFPeA | | 83 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 82 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: WL30065-006MS
Batch: 28297
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/13/2022 1107

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 81 | 50-150 |
| 13C8_PFOSA | | 87 | 50-150 |
| 13C9_PFNA | | 81 | 50-150 |
| d5-EtFOSAA | | 91 | 50-150 |
| d-MeFOSA | | 65 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: WL30065-007DU
Batch: 28297
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/13/2022 1107

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 16 | | 1 | 7.7 | 20 | 01/16/2022 0508 |
| 6:2 FTS | 5.5 | 5.0 | J | 1 | 9.4 | 20 | 01/16/2022 0508 |
| 4:2 FTS | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| EtFOSAA | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| MeFOSA | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| MeFOSAA | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| PFBS | 5.4 | 5.7 | | 1 | 6.5 | 20 | 01/16/2022 0508 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| PFHpS | 9.1 | 9.4 | | 1 | 3.8 | 20 | 01/16/2022 0508 |
| PFNS | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| PFOSA | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| PFPeS | 7.9 | 7.7 | | 1 | 2.4 | 20 | 01/16/2022 0508 |
| PFHxS | 130 | 140 | | 1 | 1.6 | 20 | 01/16/2022 0508 |
| PFBA | 14 | 14 | | 1 | 0.14 | 20 | 01/16/2022 0508 |
| PFDA | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| PFHpA | 11 | 9.8 | | 1 | 7.8 | 20 | 01/16/2022 0508 |
| PFHxA | 18 | 17 | | 1 | 4.3 | 20 | 01/16/2022 0508 |
| PFNA | 3.7 | 3.7 | J | 1 | 0.70 | 20 | 01/16/2022 0508 |
| PFOA | 23 | 23 | | 1 | 0.28 | 20 | 01/16/2022 0508 |
| PFPeA | 14 | 14 | | 1 | 0.010 | 20 | 01/16/2022 0508 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| PFUdA | ND | ND | | 1 | 0.00 | 20 | 01/16/2022 0508 |
| PFOS | 720 | 710 | | 1 | 2.0 | 20 | 01/16/2022 0508 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 115 | 50-150 |
| 13C2_6:2FTS | | 112 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 |
| 13C2_PFDoA | | 69 | 50-150 |
| 13C2_PFTeDA | N | 42 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 103 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 95 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 100 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: WL30065-007DU
Batch: 28297
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/13/2022 1107

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 99 | 50-150 |
| 13C9_PFNA | | 85 | 50-150 |
| d5-EtFOSAA | | 85 | 50-150 |
| d-MeFOSA | | 72 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ28521-001
Batch: 28521
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/14/2022 1732

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/15/2022 2246 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/15/2022 2246 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/15/2022 2246 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/15/2022 2246 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 01/15/2022 2246 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 01/15/2022 2246 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 01/15/2022 2246 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 108 | 50-150 |
| 13C2_6:2FTS | | 113 | 50-150 |
| 13C2_8:2FTS | | 104 | 50-150 |
| 13C2_PFDoA | | 90 | 50-150 |
| 13C2_PFTeDA | | 92 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 |
| 13C4_PFHpA | | 102 | 50-150 |
| 13C5_PFHxA | | 100 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 |
| 13C6_PFDA | | 104 | 50-150 |
| 13C7_PFUdA | | 100 | 50-150 |
| 13C8_PFOA | | 101 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ28521-001
Batch: 28521
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/14/2022 1732

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 95 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 |
| d-MeFOSA | | 77 | 50-150 |
| d3-MeFOSAA | | 100 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ28521-002
Batch: 28521
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/14/2022 1732

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 16 | | 1 | 103 | 67-138 | 01/15/2022 2257 |
| 6:2 FTS | 15 | 16 | | 1 | 105 | 64-140 | 01/15/2022 2257 |
| 4:2 FTS | 15 | 17 | | 1 | 112 | 63-143 | 01/15/2022 2257 |
| EtFOSAA | 16 | 16 | | 1 | 101 | 61-135 | 01/15/2022 2257 |
| MeFOSA | 16 | 18 | | 1 | 111 | 68-141 | 01/15/2022 2257 |
| MeFOSAA | 16 | 13 | | 1 | 82 | 65-136 | 01/15/2022 2257 |
| PFBS | 14 | 14 | | 1 | 100 | 72-130 | 01/15/2022 2257 |
| PFDS | 15 | 15 | | 1 | 99 | 53-142 | 01/15/2022 2257 |
| PFHpS | 15 | 15 | | 1 | 96 | 69-134 | 01/15/2022 2257 |
| PFNS | 15 | 17 | | 1 | 107 | 69-127 | 01/15/2022 2257 |
| PFOSA | 16 | 16 | | 1 | 102 | 67-137 | 01/15/2022 2257 |
| PFPeS | 15 | 16 | | 1 | 106 | 71-127 | 01/15/2022 2257 |
| PFHxS | 15 | 15 | | 1 | 104 | 68-131 | 01/15/2022 2257 |
| PFBA | 16 | 16 | | 1 | 99 | 73-129 | 01/15/2022 2257 |
| PFDA | 16 | 17 | | 1 | 108 | 71-129 | 01/15/2022 2257 |
| PFDoA | 16 | 17 | | 1 | 109 | 72-134 | 01/15/2022 2257 |
| PFHpA | 16 | 16 | | 1 | 99 | 72-130 | 01/15/2022 2257 |
| PFHxA | 16 | 17 | | 1 | 108 | 72-129 | 01/15/2022 2257 |
| PFNA | 16 | 17 | | 1 | 106 | 69-130 | 01/15/2022 2257 |
| PFOA | 16 | 17 | | 1 | 107 | 71-133 | 01/15/2022 2257 |
| PFPeA | 16 | 16 | | 1 | 102 | 72-129 | 01/15/2022 2257 |
| PFTeDA | 16 | 17 | | 1 | 105 | 71-132 | 01/15/2022 2257 |
| PFTrDA | 16 | 16 | | 1 | 102 | 65-144 | 01/15/2022 2257 |
| PFUdA | 16 | 16 | | 1 | 102 | 69-133 | 01/15/2022 2257 |
| PFOS | 15 | 16 | | 1 | 105 | 65-140 | 01/15/2022 2257 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 85 | 50-150 |
| 13C2_6:2FTS | | 109 | 50-150 |
| 13C2_8:2FTS | | 94 | 50-150 |
| 13C2_PFDoA | | 84 | 50-150 |
| 13C2_PFTeDA | | 86 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 |
| 13C5_PFHxA | | 89 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 92 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ28521-002
Batch: 28521
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/14/2022 1732

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 88 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 |
| 13C9_PFNA | | 90 | 50-150 |
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 72 | 50-150 |
| d3-MeFOSAA | | 96 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 128457

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck | Telephone No. / E-mail: 231-534-5092 | Quote No. |
| Address: 28550 Cabot Drive Ste 500 | Sampler's Signature: X | Analysis (Attach list if more space is needed) | Page 1 of 2 |
| City: Novi | State: MI | Zip Code: 48377 | Printed Name: Kristen Hasbrouck |
| Project Name: ESTCP GMAF Ventilation | | | |
| Project No.: 30027241.00002 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Sample Type (G=Grab, C=Composite) | Matrix: Aqueous | Matrix: Solid | Matrix: Other | No. of Containers by Preservative Type: Unpres | HNO3 | HCl | H2SO4 | NaOH | ZnAc/NaOH | Methanol | PFAS - QSM Table B-15 | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-VRTB-2S_12272021 | 12/27 | 1509 | G | X | | | 2 | | | | | | | X | |
| MW-VRTB-2D_12272021 | 12/27 | 1535 | G | X | | | 2 | | | | | | | X | |
| MW-VRTB-3_12272021 | 12/27 | 1639 | G | X | | | 2 | | | | | | | X | |
| Dup-02_12272021 | 12/27 | — | G | X | | | 2 | | | | | | | X | |
| VRTB-L-B1_12272021 | 12/27 | 1242 | G | X | | | 2 | | | | | | | X | |
| VRTB-L-S2_12272021 | 12/27 | 1147 | G | X | | | 2 | | | | | | | X | |
| VRTB-L-Y3_12272021 | 12/27 | 1146 | G | X | | | 2 | | | | | | | X | |
| VRTB-L-G4_12272021 | 12/27 | 1100 | G | X | | | 2 | | | | | | | X | |
| VRTB-L-M5_12232021 | 12/23 | 1515 | G | X | | | 2 | | | | | | | X | |
| VRTB-L-O6_12232021 | 12/23 | 1653 | G | X | | | 2 | | | | | | | X | |

WL30065

KES2

all samples likely to contain high PFAS concentrations

Turn Around Time Required (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client X Disposal by Lab

Possible Hazard Identification: X Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify): Level II, EDD

| | Relinquished by | Date | Time | Received by | Date | Time |
|---|---|---|---|---|---|---|
| 1 | Kristen Hasbrouck | 12/29/21 | | FedEx | 12/29/21 | |
| 2 | | Date | Time | Received by | Date | Time |
| 3 | Relinquished by | Date | Time | Received by | Date | Time |
| 4 | Relinquished by: FedEx | Date: 12/30/21 | Time: 1537 | Laboratory received by | Date: 12/30/21 | Time: 1537 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on ice (Circle) Yes No (Ice Pack) Receipt Temp: 8.8 °C Temp Blank ☐ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 128458

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck | Telephone No. / E-mail: 231-534-5092 | Quote No. |
| Address: 28550 Cabot Dr Ste 500 | Sampler's Signature: x [signature] | Analysis (Attach list if more space is needed): 8 PFAS - QSM 5.3 Table B-15 | Page 2 of 2 |
| City: Novi / State: MI / Zip Code: 48377 | Printed Name: Kristen Hasbrouck | | |
| Project Name: ESTCP GAAF Vantage | | | |
| Project No.: 30027244.00002 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab (G) or Composite (C) | Matrix: Aqueous | Matrix: Solid | Matrix: Non-Aqueous | No. of Containers by Preservative Type: Unpres. | HNO3 | H2SO4 | NaOH | NaOH+ZnAc | Trizma | Field Filtered | 8 PFAS - QSM 5.3 Table B-15 | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-L-P7_12232021 | 12/23 | 1638 | G | X | | | 2 | | | | | | | X | |
| VRTB-L-BB8_12272021 | 12/27 | 1355 | G | X | | | 2 | | | | | | | X | |
| VRTB-S-B1_12232021 | 12/23 | 1318 | G | X | | | 2 | | | | | | | X | |
| VRTB-S-S2_12232021 | 12/23 | 1145 | G | X | | | 2 | | | | | | | X | |
| VRTB-S-Y3_12232021 | 12/23 | 1227 | G | X | | | 2 | | | | | | | X | |
| VRTB-S-G4_12232021 | 12/23 | 1125 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-M5_12212021 | 12/21 | 1605 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-O6_12212021 | 12/21 | 1421 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-R7_12212021 | 12/21 | 1545 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-P8_12212021 | 12/21 | 1424 | G | X | | | 2 | | | | | | | X | |

WL30065

KES2

Remarks / Cooler I.D.

all samples shipped to Eurofins Lancaster for PFAS concentrations

| | |
|---|---|
| Turn Around Time Required (Prior lab approval required for expedited TAT): X Standard ☐ Rush (Specify) | Sample Disposal: ☐ Return to Client X Disposal by Lab |
| Possible Hazard Identification: X Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown | QC Requirements (Specify): Level II, EDD |

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by: Kristen Hasbrouck [signature] | 12/29/21 | | 1. Received by: FedEx | 12/29/21 | |
| 2. Relinquished by | Date | Time | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: FedEx | Date: 12/30/21 | Time: 1537 | 4. Laboratory received by: [signature] | Date: 12/30/21 | Time: 1537 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle) Yes No (Ice Pack) Receipt Temp: 2.8 °C
Temp Blank ☐ Y X N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK Field/Client Copy

Document Number: ME003N2-01

Pace Analytical

**Samples Receipt Checklist (SRC) (ME0018C-15)**
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

# Sample Receipt Checklist (SRC)

Client: Arcadis  Cooler Inspected by/date: JRG2 / 12/30/2021  Lot #: WL33065

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☐ Yes | ☑ No | | 1. Were custody seals present on the cooler? |
| ☐ Yes | ☐ No | ☑ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: NA

8.8 / 8.8 °C  NA / NA °C  NA / NA °C  NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles  IR Gun ID: 5  IR Gun Correction Factor: 0 °C

Method of coolant: ☐ Wet Ice ☑ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | ☐ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone (email) face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☐ Yes | ☑ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS? |
| ☐ Yes | ☑ No | | 21. Was the quote number listed on the container label? If yes, Quote # |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA. Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2  Date: 12/30/2021

Comments:

# Performance Monitoring Event #2

*LELAP CERTIFICATE NUMBER: 01955*
*DOD-ELAP ACCREDITATION NUMBER: 74960*

# ANALYTICAL RESULTS

**PERFORMED BY**

**Pace Analytical Gulf Coast**
**7979 Innovation Park Dr.**
**Baton Rouge, LA 70820**
**(225) 769-4900**

**Report Date** 05/10/2022

**Report #** 222041920

***Project*** XD16001 ESTCP Vertebrae

**Samples Collected** 4/15/22

| ***Deliver To*** | ***Additional Recipients*** |
|---|---|
| Kathy Smith<br>Pace Analytical<br>106 Vantage Point Drive<br>Columbia, SC 29223<br>803-227-2704 | NONE |

# Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with Pace Gulf Coast's Standard Operating Procedures.

**Common Abbreviations that may be Utilized in this Report**

| | |
|---|---|
| **ND** | Indicates the result was Not Detected at the specified reporting limit |
| **NO** | Indicates the sample did not ignite when preliminary test performed for EPA Method 1030 |
| **DO** | Indicates the result was Diluted Out |
| **MI** | Indicates the result was subject to Matrix Interference |
| **TNTC** | Indicates the result was Too Numerous To Count |
| **SUBC** | Indicates the analysis was Sub-Contracted |
| **FLD** | Indicates the analysis was performed in the Field |
| **DL** | Detection Limit |
| **LOD** | Limit of Detection |
| **LOQ** | Limit of Quantitation |
| **RE** | Re-analysis |
| **CF** | HPLC or GC Confirmation |
| **00:01** | Reported as a time equivalent to 12:00 AM |

**Reporting Flags that may be Utilized in this Report**

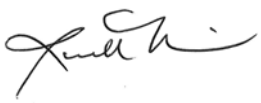
| | |
|---|---|
| **J or I** | Indicates the result is between the MDL and LOQ |
| **J** | DOD flag on analyte in the parent sample for MS/MSD outside acceptance criteria |
| **U** | Indicates the compound was analyzed for but not detected |
| **B or V** | Indicates the analyte was detected in the associated Method Blank |
| **Q** | Indicates a non-compliant QC Result (See Q Flag Application Report) |
| ***** | Indicates a non-compliant or not applicable QC recovery or RPD – see narrative |
| **E** | Organics **-** The result is estimated because it exceeded the instrument calibration range |
| **E** | Metals - % diference for the serial dilution is > 10% |
| **L** | Reporting Limits adjusted to meet risk-based limit. |
| **P** | RPD between primary and confirmation result is greater than 40 |
| **DL** | Diluted analysis – when appended to Client Sample ID |

Sample receipt at Pace Gulf Coast is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of Pace Gulf Coast. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with The NELAC Institute (TNI) Standard 2009 and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.



Authorized Signature
Pace Gulf Coast Report 222041920

# Certifications

| Certification | Certification Number |
|---|---|
| DOD ELAP | 74960 |
| Alabama | 01955 |
| Arkansas | 88-0655 |
| Colorado | 01955 |
| Delaware | 01955 |
| Florida | E87854 |
| Georgia | 01955 |
| Hawaii | 01955 |
| Idaho | 01955 |
| Illinois | 200048 |
| Indiana | 01955 |
| Kansas | E-10354 |
| Kentucky | 95 |
| Louisiana | 01955 |
| Maryland | 01955 |
| Massachusetts | 01955 |
| Michigan | 01955 |
| Mississippi | 01955 |
| Missouri | 01955 |
| Montana | N/A |
| Nebraska | 01955 |
| New Mexico | 01955 |
| North Carolina | 618 |
| North Dakota | R-195 |
| Oklahoma | 9403 |
| South Carolina | 73006001 |
| South Dakota | 01955 |
| Tennessee | 01955 |
| Texas | T104704178 |
| Vermont | 01955 |
| Virginia | 460215 |
| Washington | C929 |
| USDA Soil Permit | P330-16-00234 |

# Case Narrative

**Client:** Pace Analytical Services **Report:** 222041920

Pace Analytical Gulf Coast received and analyzed the sample(s) listed
on the Report Sample Summary page of this report. Receipt of the sample(s) is documented
by the attached chain of custody. This applies only to the sample(s) listed in this report.
No sample integrity or quality control exceptions were identified unless noted below.

**SEMI-VOLATILES MASS SPECTROMETRY**

In the PFAS Top Assay QSM B15 (Pre) analysis, the recovery for the extracted internal standard M2 6:2 FTS is above the upper control limits for sample 22204192001 (CMT-VRTB-01_7_04152022) . There are no target hits for the associated compounds.

# Sample Summary

| Lab ID | Client ID | Matrix | Collect Date | Receive Date |
|---|---|---|---|---|
| 22204192001 | CMT-VRTB-01_7_04152022 | Water | 4/15/22 08:20 | 4/19/22 10:00 |
| 22204192002 | CMT-VRTB-01_7_04152022-MS | Water | 4/15/22 08:20 | 4/19/22 10:00 |
| 22204192003 | CMT-VRTB-01_7_04152022-MSD | Water | 4/15/22 08:20 | 4/19/22 10:00 |
| 22204192004 | CMT-VRTB-01_6_04152022 | Water | 4/15/22 09:05 | 4/19/22 10:00 |
| 22204192005 | CMT-VRTB-01_5_04152022 | Water | 4/15/22 09:35 | 4/19/22 10:00 |
| 22204192006 | CMT-VRTB-01_4_04152022 | Water | 4/15/22 10:15 | 4/19/22 10:00 |
| 22204192007 | CMT-VRTB-01_3_04152022 | Water | 4/15/22 10:45 | 4/19/22 10:00 |
| 22204192008 | CMT-VRTB-01_2_04152022 | Water | 4/15/22 11:20 | 4/19/22 10:00 |
| 22204192009 | CMT-VRTB-01_1_04152022 | Water | 4/15/22 11:50 | 4/19/22 10:00 |

# Detect Summary

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22204192001 | CMT-VRTB-01_7_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 24.9 | 1 | NA |
| 22204192001 | CMT-VRTB-01_7_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 5.34J | 1 | NA |
| 22204192001 | CMT-VRTB-01_7_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 7.15J | 1 | NA |
| 22204192001 | CMT-VRTB-01_7_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 3.02J | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 7.32J | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 68.5 | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 3.98J | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 8.81J | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 131 | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 68.8 | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 74.8 | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 10.7 | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 10.7 | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 63.9 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 7.44J | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 61.8 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 3.06J | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 10.5 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 114 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 42.1 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 84.9 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 11.9 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 10.0 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 42.9 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 7.71J | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 62.8 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 5.60J | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 13.4 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 143 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 98.4 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorononanoic acid (PFNA) | ng/L | 3.82J | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 540 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 15.8 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 11.2 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 52.0 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 6.74J | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 53.1 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 9.77J | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 21.4 | 1 | NA |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 235 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 295 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorononanoic acid (PFNA) | ng/L | 9.03J | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 1830 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 24.7 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 10.6 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 81.1 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 25.1 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 299 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 121 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 199 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 2450 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 4400 | 10 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorononanoic acid (PFNA) | ng/L | 56.7 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 20500 | 10 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 228 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 66.9 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 976 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 76.6 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 40.9 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 11.1 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 88.2 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 42.7 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 126 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 204 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 95.6 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 101 | 1 | NA |

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22204192001 | CMT-VRTB-01_7_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 1.83J | 1 | NA |
| 22204192001 | CMT-VRTB-01_7_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 23.9 | 1 | NA |
| 22204192001 | CMT-VRTB-01_7_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 9.01J | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 8.43J | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 16.3 | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 4.27J | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 8.59J | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 128 | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 21.8 | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 76.9 | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 11.3 | 1 | NA |
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 11.2 | 1 | NA |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22204192004 | CMT-VRTB-01_6_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 19.2 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 8.13J | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 11.7 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 3.53J | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 9.86J | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 113 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 18.7 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 84.6 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 12.1 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 10.5 | 1 | NA |
| 22204192005 | CMT-VRTB-01_5_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 16.5 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 8.38J | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 13.4 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 5.83J | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 11.7 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 139 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 20.7 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorononanoic acid (PFNA) | ng/L | 3.57J | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorooctane Sulfonamide (FOSA) | ng/L | 2.44J | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 528 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 15.9 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 10.5 | 1 | NA |
| 22204192006 | CMT-VRTB-01_4_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 18.6 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 9.85J | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 6.94J | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 7.47J | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 14.3 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 10.5 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 16.1 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 231 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 26.1 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorononanoic acid (PFNA) | ng/L | 9.49J | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 1830 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 22.9 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 10.4 | 1 | NA |
| 22204192007 | CMT-VRTB-01_3_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 22.2 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 90.2 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 24.4 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 23.7 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 32.9 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 112 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 105 | 1 | NA |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 2130 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 183 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorononanoic acid (PFNA) | ng/L | 62.7 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorooctane Sulfonamide (FOSA) | ng/L | 2.08J | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 22500 | 10 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 194 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 59.8 | 1 | NA |
| 22204192008 | CMT-VRTB-01_2_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 85.3 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 68.0 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorobutanoic acid (PFBA) | ng/L | 34.4 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 10.1 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 78.0 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 38.1 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorohexanoic acid (PFHxA) | ng/L | 62.2 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 190 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluorooctanoic acid (PFOA) | ng/L | 94.9 | 1 | NA |
| 22204192009 | CMT-VRTB-01_1_04152022 | Perfluoropentanoic acid (PFPeA) | ng/L | 82.2 | 1 | NA |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_7_04152022** | **Collect Date** | 04/15/2022 08:20 | **Lab ID** | 22204192001 |
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 04/23/22 09:12 | 739247 | PFAS Top Assay QSM B15 (Pre) | 1 | 04/26/22 10:07 | 739356 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **1.83J** | 1.55 | 10.0 | ng/L |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 3.80U | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 3.05U | 3.05 | 10.0 | ng/L |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 2.90U | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **23.9** | 3.10 | 10.0 | ng/L |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 2.35U | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 2.45U | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **9.01J** | 1.90 | 10.0 | ng/L |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 2.10U | 2.10 | 10.0 | ng/L |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 2.55U | 2.55 | 10.0 | ng/L |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 2.20U | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 561 | ng/L | 112 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 282 | ng/L | 113 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 302 | ng/L | 121 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 332 | ng/L | 133 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 395 | ng/L | **158*** | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 347 | ng/L | 139 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 252 | ng/L | 101 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 252 | ng/L | 101 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 280 | ng/L | 112 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 279 | ng/L | 112 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 261 | ng/L | 104 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 256 | ng/L | 103 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 278 | ng/L | 111 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 277 | ng/L | 111 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 290 | ng/L | 116 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 267 | ng/L | 107 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_7_04152022** | **Collect Date** | 04/15/2022 08:20 | **Lab ID** | 22204192001 |
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 05/04/22 09:30 | 739710 | PFAS Top Assay QSM B15 (Post) | 1 | 05/04/22 21:01 | 740217 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 1.55U | 1.55 | 10.0 | ng/L |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 3.80U | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 3.05U | 3.05 | 10.0 | ng/L |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 2.90U | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **24.9** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **5.34J** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 2.45U | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **7.15J** | 1.90 | 10.0 | ng/L |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 2.10U | 2.10 | 10.0 | ng/L |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 2.55U | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **3.02J** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 448 | ng/L | 90 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 207 | ng/L | 83 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 226 | ng/L | 90 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 177 | ng/L | 71 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 168 | ng/L | 67 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 183 | ng/L | 73 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 215 | ng/L | 86 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 292 | ng/L | 117 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 271 | ng/L | 108 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 253 | ng/L | 101 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 266 | ng/L | 107 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 237 | ng/L | 95 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 238 | ng/L | 95 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 209 | ng/L | 84 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 248 | ng/L | 99 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 250 | ng/L | 100 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 243 | ng/L | 97 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 249 | ng/L | 100 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 228 | ng/L | 91 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_7_04152022-MS** | **Collect Date** | 04/15/2022 08:20 | **Lab ID** | 22204192002 |
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 04/23/22 09:12 | 739247 | PFAS Top Assay QSM B15 (Pre) | 1 | 04/26/22 10:22 | 739356 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | **11Cl-PF3OUdS** | **147** | 2.25 | 10.0 | ng/L |
| 757124-72-4 | **4:2 Fluorotelomer sulfonic acid (4:2 FTS)** | **162** | 3.10 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **158** | 3.75 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **165** | 2.65 | 10.0 | ng/L |
| 756426-58-1 | **9Cl-PF3ONS** | **150** | 2.25 | 10.0 | ng/L |
| 919005-14-4 | **ADONA** | **160** | 2.15 | 10.0 | ng/L |
| 2991-50-6 | **NEtFOSAA** | **173** | 3.95 | 20.0 | ng/L |
| 2355-31-9 | **NMeFOSAA** | **176** | 2.25 | 20.0 | ng/L |
| 13252-13-6 | **Perfluoro-2-proxypropanoic acid (HFPO-DA)** | **366** | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **158** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **176** | 3.80 | 10.0 | ng/L |
| 335-77-3 | **Perfluorodecane sulfonic acid (PFDS)** | **165** | 3.05 | 10.0 | ng/L |
| 335-76-2 | **Perfluorodecanoic acid (PFDA)** | **172** | 3.60 | 10.0 | ng/L |
| 307-55-1 | **Perfluorododecanoic acid (PFDoA)** | **175** | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **171** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **172** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **181** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **175** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | **Perfluorononanesulfonic acid (PFNS)** | **166** | 4.35 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **173** | 2.45 | 10.0 | ng/L |
| 754-91-6 | **Perfluorooctane Sulfonamide (FOSA)** | **179** | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **169** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **174** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **163** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **177** | 2.20 | 10.0 | ng/L |
| 376-06-7 | **Perfluorotetradecanoic acid (PFTA)** | **176** | 2.85 | 10.0 | ng/L |
| 72629-94-8 | **Perfluorotridecanoic acid (PFTrDA)** | **173** | 3.08 | 10.0 | ng/L |
| 2058-94-8 | **Perfluoroundecanoic acid (PFUnA)** | **171** | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 556 | ng/L | 111 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 272 | ng/L | 109 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 283 | ng/L | 113 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 313 | ng/L | 125 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 347 | ng/L | 139 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 333 | ng/L | 133 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 242 | ng/L | 97 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 273 | ng/L | 109 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 271 | ng/L | 108 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 257 | ng/L | 103 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 256 | ng/L | 103 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 265 | ng/L | 106 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 259 | ng/L | 104 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 284 | ng/L | 114 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 256 | ng/L | 102 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 258 | ng/L | 103 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_7_04152022-MS** | **Collect Date** | 04/15/2022 08:20 | **Lab ID** | 22204192002 |
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 05/04/22 09:30 | 739710 | PFAS Top Assay QSM B15 (Post) | 1 | 05/04/22 21:16 | 740217 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | **11Cl-PF3OUdS** | **163** | 2.25 | 10.0 | ng/L |
| 757124-72-4 | **4:2 Fluorotelomer sulfonic acid (4:2 FTS)** | **181** | 3.10 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **185** | 3.75 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **183** | 2.65 | 10.0 | ng/L |
| 756426-58-1 | **9Cl-PF3ONS** | **170** | 2.25 | 10.0 | ng/L |
| 919005-14-4 | **ADONA** | **181** | 2.15 | 10.0 | ng/L |
| 2991-50-6 | **NEtFOSAA** | **185** | 3.95 | 20.0 | ng/L |
| 2355-31-9 | **NMeFOSAA** | **188** | 2.25 | 20.0 | ng/L |
| 13252-13-6 | **Perfluoro-2-proxypropanoic acid (HFPO-DA)** | **375** | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **167** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **191** | 3.80 | 10.0 | ng/L |
| 335-77-3 | **Perfluorodecane sulfonic acid (PFDS)** | **178** | 3.05 | 10.0 | ng/L |
| 335-76-2 | **Perfluorodecanoic acid (PFDA)** | **194** | 3.60 | 10.0 | ng/L |
| 307-55-1 | **Perfluorododecanoic acid (PFDoA)** | **187** | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **175** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **188** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **197** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **192** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | **Perfluorononanesulfonic acid (PFNS)** | **181** | 4.35 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **186** | 2.45 | 10.0 | ng/L |
| 754-91-6 | **Perfluorooctane Sulfonamide (FOSA)** | **193** | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **181** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **185** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **179** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **191** | 2.20 | 10.0 | ng/L |
| 376-06-7 | **Perfluorotetradecanoic acid (PFTA)** | **190** | 2.85 | 10.0 | ng/L |
| 72629-94-8 | **Perfluorotridecanoic acid (PFTrDA)** | **192** | 3.08 | 10.0 | ng/L |
| 2058-94-8 | **Perfluoroundecanoic acid (PFUnA)** | **188** | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 432 | ng/L | 86 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 192 | ng/L | 77 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 201 | ng/L | 80 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 159 | ng/L | 64 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 151 | ng/L | 61 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 167 | ng/L | 67 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 207 | ng/L | 83 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 299 | ng/L | 120 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 263 | ng/L | 105 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 248 | ng/L | 99 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 252 | ng/L | 101 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 220 | ng/L | 88 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 215 | ng/L | 86 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 199 | ng/L | 79 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 243 | ng/L | 97 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 230 | ng/L | 92 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 230 | ng/L | 92 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 246 | ng/L | 98 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 206 | ng/L | 82 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_7_04152022-MSD** | **Collect Date** | 04/15/2022 08:20 | **Lab ID** | 22204192003 |
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 04/23/22 09:12 | 739247 | PFAS Top Assay QSM B15 (Pre) | 1 | 04/26/22 10:37 | 739356 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | **11Cl-PF3OUdS** | **157** | 2.25 | 10.0 | ng/L |
| 757124-72-4 | **4:2 Fluorotelomer sulfonic acid (4:2 FTS)** | **163** | 3.10 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **163** | 3.75 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **179** | 2.65 | 10.0 | ng/L |
| 756426-58-1 | **9Cl-PF3ONS** | **152** | 2.25 | 10.0 | ng/L |
| 919005-14-4 | **ADONA** | **161** | 2.15 | 10.0 | ng/L |
| 2991-50-6 | **NEtFOSAA** | **175** | 3.95 | 20.0 | ng/L |
| 2355-31-9 | **NMeFOSAA** | **179** | 2.25 | 20.0 | ng/L |
| 13252-13-6 | **Perfluoro-2-proxypropanoic acid (HFPO-DA)** | **365** | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **160** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **181** | 3.80 | 10.0 | ng/L |
| 335-77-3 | **Perfluorodecane sulfonic acid (PFDS)** | **165** | 3.05 | 10.0 | ng/L |
| 335-76-2 | **Perfluorodecanoic acid (PFDA)** | **179** | 3.60 | 10.0 | ng/L |
| 307-55-1 | **Perfluorododecanoic acid (PFDoA)** | **173** | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **175** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **177** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **185** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **180** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | **Perfluorononanesulfonic acid (PFNS)** | **167** | 4.35 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **179** | 2.45 | 10.0 | ng/L |
| 754-91-6 | **Perfluorooctane Sulfonamide (FOSA)** | **185** | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **172** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **178** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **169** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **180** | 2.20 | 10.0 | ng/L |
| 376-06-7 | **Perfluorotetradecanoic acid (PFTA)** | **177** | 2.85 | 10.0 | ng/L |
| 72629-94-8 | **Perfluorotridecanoic acid (PFTrDA)** | **172** | 3.08 | 10.0 | ng/L |
| 2058-94-8 | **Perfluoroundecanoic acid (PFUnA)** | **182** | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 560 | ng/L | 112 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 270 | ng/L | 108 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 279 | ng/L | 112 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 315 | ng/L | 126 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 347 | ng/L | 139 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 311 | ng/L | 124 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 243 | ng/L | 97 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 236 | ng/L | 95 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 270 | ng/L | 108 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 267 | ng/L | 107 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 251 | ng/L | 101 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 252 | ng/L | 101 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 256 | ng/L | 102 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 264 | ng/L | 105 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 257 | ng/L | 103 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 280 | ng/L | 112 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 261 | ng/L | 104 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 254 | ng/L | 102 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 265 | ng/L | 106 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_7_04152022-MSD** | **Collect Date** | 04/15/2022 08:20 | **Lab ID** | 22204192003 |
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 05/04/22 09:30 | 739710 | PFAS Top Assay QSM B15 (Post) | 1 | 05/04/22 21:31 | 740217 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | **11Cl-PF3OUdS** | **172** | 2.25 | 10.0 | ng/L |
| 757124-72-4 | **4:2 Fluorotelomer sulfonic acid (4:2 FTS)** | **183** | 3.10 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **184** | 3.75 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **176** | 2.65 | 10.0 | ng/L |
| 756426-58-1 | **9Cl-PF3ONS** | **172** | 2.25 | 10.0 | ng/L |
| 919005-14-4 | **ADONA** | **181** | 2.15 | 10.0 | ng/L |
| 2991-50-6 | **NEtFOSAA** | **190** | 3.95 | 20.0 | ng/L |
| 2355-31-9 | **NMeFOSAA** | **188** | 2.25 | 20.0 | ng/L |
| 13252-13-6 | **Perfluoro-2-proxypropanoic acid (HFPO-DA)** | **395** | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **171** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **195** | 3.80 | 10.0 | ng/L |
| 335-77-3 | **Perfluorodecane sulfonic acid (PFDS)** | **186** | 3.05 | 10.0 | ng/L |
| 335-76-2 | **Perfluorodecanoic acid (PFDA)** | **195** | 3.60 | 10.0 | ng/L |
| 307-55-1 | **Perfluorododecanoic acid (PFDoA)** | **192** | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **181** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **186** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **202** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **193** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | **Perfluorononanesulfonic acid (PFNS)** | **185** | 4.35 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **187** | 2.45 | 10.0 | ng/L |
| 754-91-6 | **Perfluorooctane Sulfonamide (FOSA)** | **199** | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **181** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **190** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **178** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **195** | 2.20 | 10.0 | ng/L |
| 376-06-7 | **Perfluorotetradecanoic acid (PFTA)** | **185** | 2.85 | 10.0 | ng/L |
| 72629-94-8 | **Perfluorotridecanoic acid (PFTrDA)** | **192** | 3.08 | 10.0 | ng/L |
| 2058-94-8 | **Perfluoroundecanoic acid (PFUnA)** | **189** | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 415 | ng/L | 83 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 189 | ng/L | 76 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 203 | ng/L | 81 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 156 | ng/L | 62 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 138 | ng/L | 55 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 167 | ng/L | 67 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 201 | ng/L | 80 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 242 | ng/L | 97 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 229 | ng/L | 92 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 236 | ng/L | 94 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 241 | ng/L | 96 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 228 | ng/L | 91 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 215 | ng/L | 86 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 214 | ng/L | 85 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 185 | ng/L | 74 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 224 | ng/L | 90 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 224 | ng/L | 90 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 221 | ng/L | 88 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 187 | ng/L | 75 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 204 | ng/L | 82 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01_6_04152022** | **Collect Date** | 04/15/2022 09:05 | **Lab ID** | 22204192004 |
|---|---|---|---|---|
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 04/23/22 09:12 | 739247 | PFAS Top Assay QSM B15 (Pre) | 1 | 04/26/22 10:52 | 739356 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **8.43J** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **16.3** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **4.27J** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **8.59J** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **128** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **21.8** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 2.45U | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **76.9** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **11.3** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **11.2** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **19.2** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 566 | ng/L | 113 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 276 | ng/L | 110 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 294 | ng/L | 118 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 326 | ng/L | 130 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 372 | ng/L | 149 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 348 | ng/L | 139 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 256 | ng/L | 102 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 247 | ng/L | 99 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 278 | ng/L | 111 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 276 | ng/L | 110 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 257 | ng/L | 103 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 257 | ng/L | 103 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 271 | ng/L | 108 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 275 | ng/L | 110 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 270 | ng/L | 108 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 266 | ng/L | 106 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 288 | ng/L | 115 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 270 | ng/L | 108 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 266 | ng/L | 106 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01_6_04152022** | **Collect Date** | 04/15/2022 09:05 | **Lab ID** | 22204192004 |
|---|---|---|---|---|
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 05/04/22 09:30 | 739710 | PFAS Top Assay QSM B15 (Post) | 1 | 05/04/22 21:45 | 740217 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **7.32J** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **68.5** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **3.98J** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **8.81J** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **131** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **68.8** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 2.45U | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **74.8** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **10.7** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **10.7** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **63.9** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 437 | ng/L | 87 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 213 | ng/L | 85 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 232 | ng/L | 93 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 186 | ng/L | 74 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 167 | ng/L | 67 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 191 | ng/L | 76 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 228 | ng/L | 91 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 320 | ng/L | 128 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 277 | ng/L | 111 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 260 | ng/L | 104 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 276 | ng/L | 110 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 265 | ng/L | 106 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 248 | ng/L | 99 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 248 | ng/L | 99 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 232 | ng/L | 93 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 261 | ng/L | 104 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 256 | ng/L | 102 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 249 | ng/L | 100 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 195 | ng/L | 78 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 230 | ng/L | 92 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_5_04152022** | **Collect Date** | 04/15/2022 09:35 | **Lab ID** | 22204192005 |
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 04/23/22 09:12 | 739247 | PFAS Top Assay QSM B15 (Pre) | 1 | 04/26/22 11:06 | 739356 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **8.13J** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **11.7** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **3.53J** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **9.86J** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **113** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **18.7** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 2.45U | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **84.6** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **12.1** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **10.5** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **16.5** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 558 | ng/L | 112 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 270 | ng/L | 108 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 287 | ng/L | 115 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 319 | ng/L | 127 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 374 | ng/L | 150 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 330 | ng/L | 132 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 242 | ng/L | 97 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 276 | ng/L | 110 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 265 | ng/L | 106 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 254 | ng/L | 102 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 254 | ng/L | 101 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 264 | ng/L | 106 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 259 | ng/L | 104 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 261 | ng/L | 105 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 286 | ng/L | 115 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 266 | ng/L | 106 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 254 | ng/L | 102 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 253 | ng/L | 101 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01_5_04152022** | **Collect Date** | 04/15/2022 09:35 | **Lab ID** | 22204192005 |
|---|---|---|---|---|
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 05/04/22 09:30 | 739710 | PFAS Top Assay QSM B15 (Post) | 1 | 05/04/22 22:00 | 740217 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **7.44J** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **61.8** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **3.06J** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **10.5** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **114** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **42.1** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 2.45U | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **84.9** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **11.9** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **10.0** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **42.9** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 466 | ng/L | 93 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 210 | ng/L | 84 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 239 | ng/L | 96 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 182 | ng/L | 73 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 173 | ng/L | 69 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 199 | ng/L | 80 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 231 | ng/L | 93 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 328 | ng/L | 131 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 288 | ng/L | 115 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 268 | ng/L | 107 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 270 | ng/L | 108 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 281 | ng/L | 113 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 247 | ng/L | 99 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 249 | ng/L | 100 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 228 | ng/L | 91 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 266 | ng/L | 107 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 262 | ng/L | 105 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 232 | ng/L | 93 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01_4_04152022** | **Collect Date** | 04/15/2022 10:15 | **Lab ID** | 22204192006 |
|---|---|---|---|---|
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 04/23/22 09:12 | 739247 | PFAS Top Assay QSM B15 (Pre) | 1 | 04/26/22 11:21 | 739356 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **8.38J** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **13.4** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **5.83J** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **11.7** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **139** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **20.7** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **3.57J** | 2.45 | 10.0 | ng/L |
| 754-91-6 | **Perfluorooctane Sulfonamide (FOSA)** | **2.44J** | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **528** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **15.9** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **10.5** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **18.6** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 548 | ng/L | 110 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 271 | ng/L | 108 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 276 | ng/L | 110 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 335 | ng/L | 134 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 361 | ng/L | 144 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 335 | ng/L | 134 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 247 | ng/L | 99 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 286 | ng/L | 114 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 272 | ng/L | 109 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 257 | ng/L | 103 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 259 | ng/L | 104 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 262 | ng/L | 105 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 254 | ng/L | 101 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 284 | ng/L | 114 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 252 | ng/L | 101 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01_4_04152022** | **Collect Date** | 04/15/2022 10:15 | **Lab ID** | 22204192006 |
|---|---|---|---|---|
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 05/04/22 09:30 | 739710 | PFAS Top Assay QSM B15 (Post) | 1 | 05/04/22 22:15 | 740217 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **7.71J** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **62.8** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **5.60J** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **13.4** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **143** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **98.4** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **3.82J** | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **540** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **15.8** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **11.2** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **52.0** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 447 | ng/L | 89 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 206 | ng/L | 83 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 225 | ng/L | 90 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 177 | ng/L | 71 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 167 | ng/L | 67 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 196 | ng/L | 79 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 228 | ng/L | 91 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 315 | ng/L | 126 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 277 | ng/L | 111 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 258 | ng/L | 103 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 257 | ng/L | 103 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 269 | ng/L | 108 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 261 | ng/L | 104 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 243 | ng/L | 97 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 243 | ng/L | 97 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 208 | ng/L | 83 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 259 | ng/L | 103 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 247 | ng/L | 99 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 246 | ng/L | 98 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 249 | ng/L | 100 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 224 | ng/L | 90 | 50 - 150 |

# Sample Results

| CMT-VRTB-01_3_04152022 | Collect Date | 04/15/2022 10:45 | Lab ID | 22204192007 |
|---|---|---|---|---|
| | Receive Date | 04/19/2022 10:00 | Matrix | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 04/23/22 09:12 | 739247 | PFAS Top Assay QSM B15 (Pre) | 1 | 04/26/22 11:36 | 739356 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **9.85J** | 3.75 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **6.94J** | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **7.47J** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **14.3** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **10.5** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **16.1** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **231** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **26.1** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **9.49J** | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **1830** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **22.9** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **10.4** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **22.2** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 544 | ng/L | 109 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 280 | ng/L | 112 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 294 | ng/L | 118 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 345 | ng/L | 138 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 431 | ng/L | **172*** | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 339 | ng/L | 136 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 242 | ng/L | 97 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 246 | ng/L | 98 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 282 | ng/L | 113 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 268 | ng/L | 107 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 257 | ng/L | 103 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 262 | ng/L | 105 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 275 | ng/L | 110 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 262 | ng/L | 105 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 266 | ng/L | 106 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 265 | ng/L | 106 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 254 | ng/L | 101 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_3_04152022** | **Collect Date** | 04/15/2022 10:45 | **Lab ID** | 22204192007 |
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 05/04/22 09:30 | 739710 | PFAS Top Assay QSM B15 (Post) | 1 | 05/04/22 22:29 | 740217 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **6.74J** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **53.1** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **9.77J** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **21.4** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **235** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **295** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **9.03J** | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **1830** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **24.7** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **10.6** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **81.1** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 444 | ng/L | 89 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 205 | ng/L | 82 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 227 | ng/L | 91 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 181 | ng/L | 73 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 171 | ng/L | 68 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 196 | ng/L | 78 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 225 | ng/L | 90 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 316 | ng/L | 126 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 275 | ng/L | 110 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 260 | ng/L | 104 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 265 | ng/L | 106 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 274 | ng/L | 110 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 269 | ng/L | 108 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 243 | ng/L | 97 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 225 | ng/L | 90 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 259 | ng/L | 104 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 228 | ng/L | 91 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 238 | ng/L | 95 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 230 | ng/L | 92 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_2_04152022** | **Collect Date** | 04/15/2022 11:20 | **Lab ID** | 22204192008 |
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 04/23/22 09:12 | 739247 | PFAS Top Assay QSM B15 (Pre) | 1 | 04/26/22 18:08 | 739461 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **90.2** | 3.75 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **24.4** | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **23.7** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **32.9** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **112** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **105** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **2130** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **183** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **62.7** | 2.45 | 10.0 | ng/L |
| 754-91-6 | **Perfluorooctane Sulfonamide (FOSA)** | **2.08J** | 1.85 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **194** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **59.8** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **85.3** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 277 | ng/L | 111 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 294 | ng/L | 118 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 359 | ng/L | 143 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 358 | ng/L | 143 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 355 | ng/L | 142 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 251 | ng/L | 100 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 266 | ng/L | 106 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 291 | ng/L | 116 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 260 | ng/L | 104 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 270 | ng/L | 108 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 275 | ng/L | 110 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 285 | ng/L | 114 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 285 | ng/L | 114 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 279 | ng/L | 112 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 183 | ng/L | 73 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 217 | ng/L | 87 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 271 | ng/L | 109 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 265 | ng/L | 106 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01_2_04152022** | | | | |
|---|---|---|---|---|
| | **Collect Date** | 04/15/2022 11:20 | **Lab ID** | 22204192008 |
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 04/23/22 09:12 | 739247 | PFAS Top Assay QSM B15 (Pre) | 10 | 04/26/22 11:51 | 739356 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **22500** | 19.0 | 100 | | ng/L |
| **CAS#** | **Extracted Internal Standard(EIS)** | **Cal Area** | **Samp Area** | **Units** | **%Recovery** | **%Rec Limits** |
| 1763-23-1-EIS | M8PFOS | 250 | 262 | ng/L | 105 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01_2_04152022** | **Collect Date** | 04/15/2022 11:20 | **Lab ID** | 22204192008 |
|---|---|---|---|---|
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 05/04/22 09:30 | 739710 | PFAS Top Assay QSM B15 (Post) | 1 | 05/04/22 22:44 | 740217 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **25.1** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **299** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **121** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **199** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **2450** | 3.10 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **56.7** | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **228** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **66.9** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **976** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 399 | ng/L | 80 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 182 | ng/L | 73 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 200 | ng/L | 80 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 175 | ng/L | 70 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 153 | ng/L | 61 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 169 | ng/L | 68 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 199 | ng/L | 80 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 293 | ng/L | 117 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 262 | ng/L | 105 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 213 | ng/L | 85 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 250 | ng/L | 100 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 241 | ng/L | 96 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 219 | ng/L | 88 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 216 | ng/L | 86 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 203 | ng/L | 81 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 128 | ng/L | 51 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 175 | ng/L | 70 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 203 | ng/L | 81 | 50 - 150 |

# Sample Results

| CMT-VRTB-01_2_04152022 | | | | |
|---|---|---|---|---|
| | Collect Date | 04/15/2022 11:20 | Lab ID | 22204192008 |
| | Receive Date | 04/19/2022 10:00 | Matrix | Water |

## PFAS Top Assay QSM B15 (Post)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 05/04/22 09:30 | 739710 | PFAS Top Assay QSM B15 (Post) | 10 | 05/07/22 00:43 | 740339 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **4400** | 23.5 | 100 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **20500** | 19.0 | 100 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 50 | 40 | ng/L | 80 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 218 | ng/L | 87 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 221 | ng/L | 88 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01_1_04152022** | **Collect Date** | 04/15/2022 11:50 | **Lab ID** | 22204192009 |
|---|---|---|---|---|
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 04/23/22 09:12 | 739247 | PFAS Top Assay QSM B15 (Pre) | 1 | 04/26/22 12:06 | 739356 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **68.0** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **34.4** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **10.1** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **78.0** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **38.1** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **62.2** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 2.45U | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **190** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **94.9** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 2.55U | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **82.2** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 565 | ng/L | 113 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 270 | ng/L | 108 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 287 | ng/L | 115 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 336 | ng/L | 134 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 347 | ng/L | 139 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 345 | ng/L | 138 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 246 | ng/L | 98 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 269 | ng/L | 108 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 268 | ng/L | 107 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 252 | ng/L | 101 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 256 | ng/L | 102 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 271 | ng/L | 108 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 265 | ng/L | 106 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 280 | ng/L | 112 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 269 | ng/L | 108 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 251 | ng/L | 100 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 260 | ng/L | 104 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01_1_04152022** | **Collect Date** | 04/15/2022 11:50 | **Lab ID** | 22204192009 |
|---|---|---|---|---|
| | **Receive Date** | 04/19/2022 10:00 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 05/04/22 09:30 | 739710 | PFAS Top Assay QSM B15 (Post) | 1 | 05/04/22 22:59 | 740217 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **76.6** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **40.9** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **11.1** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **88.2** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **42.7** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **126** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 2.45U | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **204** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **95.6** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 2.55U | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **101** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 437 | ng/L | 87 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 191 | ng/L | 76 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 214 | ng/L | 86 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 172 | ng/L | 69 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 159 | ng/L | 64 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 178 | ng/L | 71 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 210 | ng/L | 84 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 301 | ng/L | 120 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 262 | ng/L | 105 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 247 | ng/L | 99 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 252 | ng/L | 101 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 264 | ng/L | 106 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 230 | ng/L | 92 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 231 | ng/L | 92 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 202 | ng/L | 81 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 247 | ng/L | 99 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 239 | ng/L | 96 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 235 | ng/L | 94 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 244 | ng/L | 98 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 213 | ng/L | 85 | 50 - 150 |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB739710 | LCS739710 | LCSD739710 |
|---|---|---|---|---|
| 740217 | Lab ID | 2339779 | 2339780 | 2339781 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 739710 | Prep Date | 05/04/22 09:30 | 05/04/22 09:30 | 05/04/22 09:30 |
| **Prep Method** | Analysis Date | 05/04/22 20:17 | 05/04/22 20:32 | 05/04/22 20:47 |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Post)** | | Units Result | ng/L DL | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 763051-92-9 | 0.900U | 0.900 | 75.4 | 65.2 | 86 | 70 - 130 | 75.4 | 67.2 | 89 | 3 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 1.24U | 1.24 | 75.0 | 73.2 | 98 | 70 - 130 | 75.0 | 72.9 | 97 | 0 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 1.50U | 1.50 | 76.1 | 73.5 | 97 | 70 - 130 | 76.1 | 74.7 | 98 | 2 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 1.06U | 1.06 | 76.8 | 71.6 | 93 | 70 - 130 | 76.8 | 75.4 | 98 | 5 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 0.900U | 0.900 | 74.6 | 68.2 | 91 | 70 - 130 | 74.6 | 69.0 | 93 | 1 | 20 |
| ADONA | 919005-14-4 | 0.860U | 0.860 | 75.6 | 72.4 | 96 | 70 - 130 | 75.6 | 73.4 | 97 | 1 | 20 |
| NEtFOSAA | 2991-50-6 | 1.58U | 1.58 | 80.0 | 71.6 | 90 | 70 - 130 | 80.0 | 76.8 | 96 | 7 | 20 |
| NMeFOSAA | 2355-31-9 | 0.900U | 0.900 | 80.0 | 71.7 | 90 | 70 - 130 | 80.0 | 72.9 | 91 | 2 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 6.67U | 6.67 | 160 | 158 | 99 | 70 - 130 | 160 | 154 | 96 | 3 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 0.620U | 0.620 | 71.0 | 68.4 | 96 | 70 - 130 | 71.0 | 69.1 | 97 | 1 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1.52U | 1.52 | 80.0 | 76.2 | 95 | 70 - 130 | 80.0 | 76.7 | 96 | 1 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 1.22U | 1.22 | 77.2 | 73.2 | 95 | 70 - 130 | 77.2 | 73.1 | 95 | 0 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1.44U | 1.44 | 80.0 | 75.0 | 94 | 70 - 130 | 80.0 | 78.1 | 98 | 4 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1.30U | 1.30 | 80.0 | 75.8 | 95 | 70 - 130 | 80.0 | 76.9 | 96 | 1 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1.22U | 1.22 | 76.2 | 73.0 | 96 | 70 - 130 | 76.2 | 72.0 | 95 | 1 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1.16U | 1.16 | 80.0 | 75.3 | 94 | 70 - 130 | 80.0 | 76.1 | 95 | 1 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1.24U | 1.24 | 73.1 | 70.3 | 96 | 70 - 130 | 73.1 | 70.0 | 96 | 0 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 0.940U | 0.940 | 80.0 | 74.4 | 93 | 70 - 130 | 80.0 | 76.1 | 95 | 2 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1.74U | 1.74 | 77.0 | 74.1 | 96 | 70 - 130 | 77.0 | 72.9 | 95 | 2 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 0.980U | 0.980 | 80.0 | 74.2 | 93 | 70 - 130 | 80.0 | 76.4 | 96 | 3 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 0.740U | 0.740 | 80.0 | 76.4 | 96 | 70 - 130 | 80.0 | 79.1 | 99 | 3 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 0.760U | 0.760 | 74.2 | 69.7 | 94 | 70 - 130 | 74.2 | 70.5 | 95 | 1 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 0.840U | 0.840 | 80.0 | 74.3 | 93 | 70 - 130 | 80.0 | 75.1 | 94 | 1 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1.02U | 1.02 | 75.3 | 71.8 | 95 | 70 - 130 | 75.3 | 71.6 | 95 | 0 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 0.880U | 0.880 | 80.0 | 75.0 | 94 | 70 - 130 | 80.0 | 76.2 | 95 | 2 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 1.14U | 1.14 | 80.0 | 74.8 | 94 | 70 - 130 | 80.0 | 74.7 | 93 | 0 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1.23U | 1.23 | 80.0 | 74.6 | 93 | 70 - 130 | 80.0 | 75.1 | 94 | 1 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1.24U | 1.24 | 80.0 | 74.9 | 94 | 70 - 130 | 80.0 | 74.4 | 93 | 1 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 87.6 | 88 | 100 | 84.7 | 85 | 50 - 150 | 100 | 84 | 84 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 96.5 | 97 | 100 | 89.3 | 89 | 50 - 150 | 100 | 84.7 | 85 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 89.8 | 90 | 100 | 65 | 65 | 50 - 150 | 100 | 64 | 64 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 75.8 | 76 | 100 | 62.7 | 63 | 50 - 150 | 100 | 61.5 | 61 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 84.5 | 85 | 100 | 69.9 | 70 | 50 - 150 | 100 | 67.7 | 68 | NA | NA |
| M2PFTA | 376-06-7-EIS | 91.9 | 92 | 100 | 86.2 | 86 | 50 - 150 | 100 | 83.1 | 83 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 120 | 120 | 100 | 120 | 120 | 50 - 150 | 100 | 117 | 117 | NA | NA |
| M3PFBS | 375-73-5-EIS | 109 | 109 | 100 | 103 | 103 | 50 - 150 | 100 | 103 | 103 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 105 | 105 | 100 | 98.4 | 98 | 50 - 150 | 100 | 99.6 | 100 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 107 | 107 | 100 | 101 | 101 | 50 - 150 | 100 | 99.5 | 100 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 111 | 111 | 100 | 104 | 104 | 50 - 150 | 100 | 103 | 103 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 105 | 105 | 100 | 101 | 101 | 50 - 150 | 100 | 101 | 101 | NA | NA |
| M6PFDA | 335-76-2-EIS | 98.8 | 99 | 100 | 93.2 | 93 | 50 - 150 | 100 | 92.4 | 92 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 98 | 98 | 100 | 92.2 | 92 | 50 - 150 | 100 | 91 | 91 | NA | NA |
| M8FOSA | 754-91-6-EIS | 93 | 93 | 100 | 88 | 88 | 50 - 150 | 100 | 84.9 | 85 | NA | NA |
| M8PFOA | 335-67-1-EIS | 103 | 103 | 100 | 97.7 | 98 | 50 - 150 | 100 | 96.9 | 97 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 102 | 102 | 100 | 96.9 | 97 | 50 - 150 | 100 | 96.4 | 96 | NA | NA |
| M9PFNA | 375-95-1-EIS | 102 | 102 | 100 | 95.2 | 95 | 50 - 150 | 100 | 94 | 94 | NA | NA |
| MPFBA | 375-22-4-EIS | 103 | 103 | 100 | 98.7 | 99 | 50 - 150 | 100 | 98.5 | 98 | NA | NA |
| MPFDoA | 307-55-1-EIS | 93.3 | 93 | 100 | 87.1 | 87 | 50 - 150 | 100 | 85.2 | 85 | NA | NA |
| MPFOA | 335-67-1-SUR | 196 | 98 | 200 | 195 | 98 | 50 - 150 | 200 | 194 | 97 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** 740217 **Prep Batch** 739710 **Prep Method** PFAS Top Assay QSM B15 (Post) | Client ID<br>Lab ID<br>Sample Type<br>Prep Date<br>Analysis Date<br>Matrix | CMT-VRTB-01_7_04152022<br>22204192001<br>SAMPLE<br>05/04/2022 09:30<br>05/04/2022 21:01<br>Water | CMT-VRTB-01_7_04152022-..<br>22204192002<br>MS<br>05/04/22 09:30<br>05/04/22 21:16<br>Water | CMT-VRTB-01_7_04152022-..<br>22204192003<br>MSD<br>05/04/22 09:30<br>05/04/22 21:31<br>Water |
|---|---|---|---|---|

| **PFAS Top Assay QSM B15 (Post)** | | Units<br>Result | ng/L<br>DL | Spike<br>Added | Result | %R | Control<br>Limits%R | Spike<br>Added | Result | %R | RPD | RPD<br>Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 763051-92-9 | 0.140 | 2.25 | 189 | 163 | 86 | 70 - 130 | 189 | 172 | 91 | 5 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 0.219 | 3.10 | 187 | 181 | 96 | 70 - 130 | 187 | 183 | 98 | 1 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 0.310 | 3.75 | 190 | 185 | 97 | 70 - 130 | 190 | 184 | 97 | 0 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 0.145 | 2.65 | 192 | 183 | 95 | 70 - 130 | 192 | 176 | 92 | 4 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 0.116 | 2.25 | 187 | 170 | 91 | 70 - 130 | 187 | 172 | 92 | 1 | 20 |
| ADONA | 919005-14-4 | 0.080 | 2.15 | 189 | 181 | 96 | 70 - 130 | 189 | 181 | 96 | 0 | 20 |
| NEtFOSAA | 2991-50-6 | 0.340 | 3.95 | 200 | 185 | 92 | 70 - 130 | 200 | 190 | 95 | 3 | 20 |
| NMeFOSAA | 2355-31-9 | 0.459 | 2.25 | 200 | 188 | 94 | 70 - 130 | 200 | 188 | 94 | 0 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 0.230 | 16.7 | 400 | 375 | 94 | 70 - 130 | 400 | 395 | 99 | 5 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 0.600 | 1.55 | 177 | 167 | 94 | 70 - 130 | 177 | 171 | 96 | 2 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 3.28 | 3.80 | 200 | 191 | 94 | 70 - 130 | 200 | 195 | 96 | 2 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 0.070 | 3.05 | 193 | 178 | 92 | 70 - 130 | 193 | 186 | 96 | 4 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 0.263 | 3.60 | 200 | 194 | 97 | 70 - 130 | 200 | 195 | 97 | 1 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 0.183 | 3.25 | 200 | 187 | 93 | 70 - 130 | 200 | 192 | 96 | 3 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 0.868 | 3.05 | 191 | 175 | 91 | 70 - 130 | 191 | 181 | 95 | 4 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 0.615 | 2.90 | 200 | 188 | 94 | 70 - 130 | 200 | 186 | 93 | 1 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 24.9 | 3.10 | 183 | 197 | 94 | 70 - 130 | 183 | 202 | 97 | 2 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 5.34 | 2.35 | 200 | 192 | 93 | 70 - 130 | 200 | 193 | 94 | 1 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 0.224 | 4.35 | 192 | 181 | 94 | 70 - 130 | 192 | 185 | 96 | 2 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 0.245 | 2.45 | 200 | 186 | 93 | 70 - 130 | 200 | 187 | 93 | 0 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 0.291 | 1.85 | 200 | 193 | 97 | 70 - 130 | 200 | 199 | 99 | 3 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 7.15 | 1.90 | 186 | 181 | 94 | 70 - 130 | 186 | 181 | 93 | 0 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 0.852 | 2.10 | 200 | 185 | 92 | 70 - 130 | 200 | 190 | 95 | 3 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1.27 | 2.55 | 188 | 179 | 95 | 70 - 130 | 188 | 178 | 94 | 1 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 3.02 | 2.20 | 200 | 191 | 94 | 70 - 130 | 200 | 195 | 96 | 2 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 0.229 | 2.85 | 200 | 190 | 95 | 70 - 130 | 200 | 185 | 92 | 3 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 0.160 | 3.08 | 200 | 192 | 96 | 70 - 130 | 200 | 192 | 96 | 0 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 0.188 | 3.10 | 200 | 188 | 94 | 70 - 130 | 200 | 189 | 95 | 1 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 207 | 83 | 250 | 192 | 77 | 50 - 150 | 250 | 189 | 76 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 226 | 90 | 250 | 201 | 80 | 50 - 150 | 250 | 203 | 81 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 177 | 71 | 250 | 159 | 64 | 50 - 150 | 250 | 156 | 62 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 168 | 67 | 250 | 151 | 61 | 50 - 150 | 250 | 138 | 55 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 183 | 73 | 250 | 167 | 67 | 50 - 150 | 250 | 167 | 67 | NA | NA |
| M2PFTA | 376-06-7-EIS | 215 | 86 | 250 | 207 | 83 | 50 - 150 | 250 | 201 | 80 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 292 | 117 | 250 | 299 | 120 | 50 - 150 | 250 | 268 | 107 | NA | NA |
| M3PFBS | 375-73-5-EIS | 271 | 108 | 250 | 263 | 105 | 50 - 150 | 250 | 242 | 97 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 253 | 101 | 250 | 248 | 99 | 50 - 150 | 250 | 229 | 92 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 260 | 104 | 250 | 252 | 101 | 50 - 150 | 250 | 236 | 94 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 266 | 107 | 250 | 260 | 104 | 50 - 150 | 250 | 241 | 96 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 258 | 103 | 250 | 253 | 101 | 50 - 150 | 250 | 228 | 91 | NA | NA |
| M6PFDA | 335-76-2-EIS | 237 | 95 | 250 | 220 | 88 | 50 - 150 | 250 | 215 | 86 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 238 | 95 | 250 | 215 | 86 | 50 - 150 | 250 | 214 | 85 | NA | NA |
| M8FOSA | 754-91-6-EIS | 209 | 84 | 250 | 199 | 79 | 50 - 150 | 250 | 185 | 74 | NA | NA |
| M8PFOA | 335-67-1-EIS | 248 | 99 | 250 | 243 | 97 | 50 - 150 | 250 | 224 | 90 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 250 | 100 | 250 | 230 | 92 | 50 - 150 | 250 | 224 | 90 | NA | NA |
| M9PFNA | 375-95-1-EIS | 243 | 97 | 250 | 230 | 92 | 50 - 150 | 250 | 221 | 88 | NA | NA |
| MPFBA | 375-22-4-EIS | 249 | 100 | 250 | 246 | 98 | 50 - 150 | 250 | 187 | 75 | NA | NA |
| MPFDoA | 307-55-1-EIS | 228 | 91 | 250 | 206 | 82 | 50 - 150 | 250 | 204 | 82 | NA | NA |
| MPFOA | 335-67-1-SUR | 448 | 90 | 500 | 432 | 86 | 50 - 150 | 500 | 415 | 83 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB739247 | LCS739247 | LCSD739247 |
|---|---|---|---|---|
| 739356 | Lab ID | 2337278 | 2337279 | 2337280 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 739247 | Prep Date | 04/23/22 09:12 | 04/23/22 09:12 | 04/23/22 09:12 |
| **Prep Method** | Analysis Date | 04/26/22 09:08 | 04/26/22 09:23 | 04/26/22 09:38 |
| PFAS Top Assay QSM B15 (Pre) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Pre)** | | Units | ng/L | Spike | | | | Spike | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Result | DL | Added | Result | %R | Control Limits%R | Added | Result | %R | RPD | RPD Limit |
| 11Cl-PF3OUdS | 763051-92-9 | 0.900U | 0.900 | 75.4 | 60.8 | 81 | 70 - 130 | 75.4 | 73.9 | 98 | 19 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 1.24U | 1.24 | 75.0 | 65.3 | 87 | 70 - 130 | 75.0 | 75.1 | 100 | 14 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 1.50U | 1.50 | 76.1 | 65.5 | 86 | 70 - 130 | 76.1 | 76.0 | 100 | 15 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 1.06U | 1.06 | 76.8 | 69.4 | 90 | 70 - 130 | 76.8 | 82.1 | 107 | 17 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 0.900U | 0.900 | 74.6 | 60.2 | 81 | 70 - 130 | 74.6 | 72.4 | 97 | 18 | 20 |
| ADONA | 919005-14-4 | 0.860U | 0.860 | 75.6 | 65.6 | 87 | 70 - 130 | 75.6 | 76.1 | 101 | 15 | 20 |
| NEtFOSAA | 2991-50-6 | 1.58U | 1.58 | 80.0 | 73.0 | 91 | 70 - 130 | 80.0 | 83.5 | 104 | 13 | 20 |
| NMeFOSAA | 2355-31-9 | 0.900U | 0.900 | 80.0 | 70.8 | 88 | 70 - 130 | 80.0 | 82.2 | 103 | 15 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 6.67U | 6.67 | 160 | 146 | 91 | 70 - 130 | 160 | 167 | 105 | 14 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 0.620U | 0.620 | 71.0 | 62.5 | 88 | 70 - 130 | 71.0 | 74.5 | 105 | 18 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1.52U | 1.52 | 80.0 | 71.4 | 89 | 70 - 130 | 80.0 | 85.1 | 106 | 18 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 1.22U | 1.22 | 77.2 | 67.9 | 88 | 70 - 130 | 77.2 | 79.7 | 103 | 16 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1.44U | 1.44 | 80.0 | 71.1 | 89 | 70 - 130 | 80.0 | 81.5 | 102 | 14 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1.30U | 1.30 | 80.0 | 72.2 | 90 | 70 - 130 | 80.0 | 82.9 | 104 | 14 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1.22U | 1.22 | 76.2 | 68.0 | 89 | 70 - 130 | 76.2 | 78.9 | 104 | 15 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1.16U | 1.16 | 80.0 | 70.4 | 88 | 70 - 130 | 80.0 | 82.6 | 103 | 16 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1.24U | 1.24 | 73.1 | 64.4 | 88 | 70 - 130 | 73.1 | 74.2 | 102 | 14 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 0.940U | 0.940 | 80.0 | 70.3 | 88 | 70 - 130 | 80.0 | 85.3 | 107 | 19 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1.74U | 1.74 | 77.0 | 66.3 | 86 | 70 - 130 | 77.0 | 80.9 | 105 | 20 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 0.980U | 0.980 | 80.0 | 70.1 | 88 | 70 - 130 | 80.0 | 82.8 | 103 | 17 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 0.740U | 0.740 | 80.0 | 72.1 | 90 | 70 - 130 | 80.0 | 84.1 | 105 | 15 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 0.854J | 0.760 | 74.2 | 64.5 | 87 | 70 - 130 | 74.2 | 76.2 | 103 | 17 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 0.840U | 0.840 | 80.0 | 70.2 | 88 | 70 - 130 | 80.0 | 83.0 | 104 | 17 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1.02U | 1.02 | 75.3 | 65.8 | 87 | 70 - 130 | 75.3 | 76.2 | 101 | 15 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 0.880U | 0.880 | 80.0 | 71.0 | 89 | 70 - 130 | 80.0 | 83.8 | 105 | 17 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 1.14U | 1.14 | 80.0 | 71.9 | 90 | 70 - 130 | 80.0 | 83.7 | 105 | 15 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1.23U | 1.23 | 80.0 | 69.2 | 86 | 70 - 130 | 80.0 | 82.8 | 104 | 18 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1.24U | 1.24 | 80.0 | 71.3 | 89 | 70 - 130 | 80.0 | 84.6 | 106 | 17 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 110 | 110 | 100 | 105 | 105 | 50 - 150 | 100 | 93.2 | 93 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 117 | 117 | 100 | 108 | 108 | 50 - 150 | 100 | 96.6 | 97 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 129 | 129 | 100 | 115 | 115 | 50 - 150 | 100 | 101 | 101 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 144 | 144 | 100 | 129 | 129 | 50 - 150 | 100 | 123 | 123 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 132 | 132 | 100 | 124 | 124 | 50 - 150 | 100 | 106 | 106 | NA | NA |
| M2PFTA | 376-06-7-EIS | 100 | 100 | 100 | 92.1 | 92 | 50 - 150 | 100 | 83.6 | 84 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 97.4 | 97 | 100 | 92 | 92 | 50 - 150 | 100 | 83.3 | 83 | NA | NA |
| M3PFBS | 375-73-5-EIS | 111 | 111 | 100 | 105 | 105 | 50 - 150 | 100 | 91 | 91 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 106 | 106 | 100 | 103 | 103 | 50 - 150 | 100 | 90.5 | 91 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 101 | 101 | 100 | 97 | 97 | 50 - 150 | 100 | 84.4 | 84 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 99 | 99 | 100 | 96.4 | 96 | 50 - 150 | 100 | 81.9 | 82 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 102 | 102 | 100 | 98.4 | 98 | 50 - 150 | 100 | 85.8 | 86 | NA | NA |
| M6PFDA | 335-76-2-EIS | 105 | 105 | 100 | 100 | 100 | 50 - 150 | 100 | 88.8 | 89 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 107 | 107 | 100 | 100 | 100 | 50 - 150 | 100 | 87.7 | 88 | NA | NA |
| M8FOSA | 754-91-6-EIS | 104 | 104 | 100 | 101 | 101 | 50 - 150 | 100 | 87 | 87 | NA | NA |
| M8PFOA | 335-67-1-EIS | 103 | 103 | 100 | 98.3 | 98 | 50 - 150 | 100 | 86.1 | 86 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 112 | 112 | 100 | 108 | 108 | 50 - 150 | 100 | 92 | 92 | NA | NA |
| M9PFNA | 375-95-1-EIS | 106 | 106 | 100 | 101 | 101 | 50 - 150 | 100 | 87.6 | 88 | NA | NA |
| MPFBA | 375-22-4-EIS | 102 | 102 | 100 | 97.9 | 98 | 50 - 150 | 100 | 84.5 | 84 | NA | NA |
| MPFDoA | 307-55-1-EIS | 105 | 105 | 100 | 98.1 | 98 | 50 - 150 | 100 | 85.3 | 85 | NA | NA |
| MPFOA | 335-67-1-SUR | 222 | 111 | 200 | 212 | 106 | 50 - 150 | 200 | 183 | 92 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** 739356 **Prep Batch** 739247 **Prep Method** PFAS Top Assay QSM B15 (Pre) | Client ID<br>Lab ID<br>Sample Type<br>Prep Date<br>Analysis Date<br>Matrix | CMT-VRTB-01_7_04152022<br>22204192001<br>SAMPLE<br>04/23/2022 09:12<br>04/26/2022 10:07<br>Water | | CMT-VRTB-01_7_04152022-..<br>22204192002<br>MS<br>04/23/22 09:12<br>04/26/22 10:22<br>Water | | | | CMT-VRTB-01_7_04152022-..<br>22204192003<br>MSD<br>04/23/22 09:12<br>04/26/22 10:37<br>Water | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PFAS Top Assay QSM B15 (Pre)** | | Units<br>Result | ng/L<br>DL | Spike<br>Added | Result | %R | Control<br>Limits%R | Spike<br>Added | Result | %R | RPD | RPD<br>Limit |
| 11Cl-PF3OUdS | 763051-92-9 | 0.226 | 2.25 | 189 | 147 | 78 | 70 - 130 | 189 | 157 | 83 | 6 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 0.271 | 3.10 | 187 | 162 | 86 | 70 - 130 | 187 | 163 | 87 | 0 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 0.957 | 3.75 | 190 | 158 | 83 | 70 - 130 | 190 | 163 | 85 | 3 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 0.317 | 2.65 | 192 | 165 | 86 | 70 - 130 | 192 | 179 | 93 | 9 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 0.203 | 2.25 | 187 | 150 | 80 | 70 - 130 | 187 | 152 | 81 | 1 | 20 |
| ADONA | 919005-14-4 | 0.125 | 2.15 | 189 | 160 | 85 | 70 - 130 | 189 | 161 | 85 | 1 | 20 |
| NEtFOSAA | 2991-50-6 | 0.279 | 3.95 | 200 | 173 | 86 | 70 - 130 | 200 | 175 | 87 | 1 | 20 |
| NMeFOSAA | 2355-31-9 | 0.451 | 2.25 | 200 | 176 | 88 | 70 - 130 | 200 | 179 | 89 | 2 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 0.265 | 16.7 | 400 | 366 | 92 | 70 - 130 | 400 | 365 | 91 | 0 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1.83 | 1.55 | 177 | 158 | 88 | 70 - 130 | 177 | 160 | 89 | 2 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1.88 | 3.80 | 200 | 176 | 87 | 70 - 130 | 200 | 181 | 90 | 3 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 0.312 | 3.05 | 193 | 165 | 85 | 70 - 130 | 193 | 165 | 85 | 0 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 0.314 | 3.60 | 200 | 172 | 86 | 70 - 130 | 200 | 179 | 89 | 4 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 0.251 | 3.25 | 200 | 175 | 87 | 70 - 130 | 200 | 173 | 86 | 2 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 0.939 | 3.05 | 191 | 171 | 89 | 70 - 130 | 191 | 175 | 91 | 2 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 0.564 | 2.90 | 200 | 172 | 86 | 70 - 130 | 200 | 177 | 88 | 3 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 23.9 | 3.10 | 183 | 181 | 86 | 70 - 130 | 183 | 185 | 88 | 2 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1.97 | 2.35 | 200 | 175 | 87 | 70 - 130 | 200 | 180 | 89 | 2 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 0.314 | 4.35 | 192 | 166 | 86 | 70 - 130 | 192 | 167 | 87 | 1 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 0.304 | 2.45 | 200 | 173 | 86 | 70 - 130 | 200 | 179 | 90 | 4 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 1.24 | 1.85 | 200 | 179 | 89 | 70 - 130 | 200 | 185 | 92 | 3 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 9.01 | 1.90 | 186 | 169 | 86 | 70 - 130 | 186 | 172 | 88 | 2 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 0.912 | 2.10 | 200 | 174 | 87 | 70 - 130 | 200 | 178 | 88 | 2 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1.65 | 2.55 | 188 | 163 | 86 | 70 - 130 | 188 | 169 | 89 | 4 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1.66 | 2.20 | 200 | 177 | 88 | 70 - 130 | 200 | 180 | 89 | 1 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 0.311 | 2.85 | 200 | 176 | 88 | 70 - 130 | 200 | 177 | 88 | 1 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 0.358 | 3.08 | 200 | 173 | 86 | 70 - 130 | 200 | 172 | 86 | 0 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 0.281 | 3.10 | 200 | 171 | 85 | 70 - 130 | 200 | 182 | 91 | 6 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 282 | 113 | 250 | 272 | 109 | 50 - 150 | 250 | 270 | 108 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 302 | 121 | 250 | 283 | 113 | 50 - 150 | 250 | 279 | 112 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 332 | 133 | 250 | 313 | 125 | 50 - 150 | 250 | 315 | 126 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 395 | **158*** | 250 | 347 | 139 | 50 - 150 | 250 | 347 | 139 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 347 | 139 | 250 | 333 | 133 | 50 - 150 | 250 | 311 | 124 | NA | NA |
| M2PFTA | 376-06-7-EIS | 252 | 101 | 250 | 245 | 98 | 50 - 150 | 250 | 243 | 97 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 252 | 101 | 250 | 242 | 97 | 50 - 150 | 250 | 236 | 95 | NA | NA |
| M3PFBS | 375-73-5-EIS | 280 | 112 | 250 | 273 | 109 | 50 - 150 | 250 | 270 | 108 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 279 | 112 | 250 | 271 | 108 | 50 - 150 | 250 | 267 | 107 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 261 | 104 | 250 | 257 | 103 | 50 - 150 | 250 | 251 | 101 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 256 | 103 | 250 | 255 | 102 | 50 - 150 | 250 | 252 | 101 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 263 | 105 | 250 | 256 | 103 | 50 - 150 | 250 | 256 | 102 | NA | NA |
| M6PFDA | 335-76-2-EIS | 278 | 111 | 250 | 268 | 107 | 50 - 150 | 250 | 264 | 105 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 277 | 111 | 250 | 273 | 109 | 50 - 150 | 250 | 260 | 104 | NA | NA |
| M8FOSA | 754-91-6-EIS | 267 | 107 | 250 | 265 | 106 | 50 - 150 | 250 | 255 | 102 | NA | NA |
| M8PFOA | 335-67-1-EIS | 267 | 107 | 250 | 259 | 104 | 50 - 150 | 250 | 257 | 103 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 290 | 116 | 250 | 284 | 114 | 50 - 150 | 250 | 280 | 112 | NA | NA |
| M9PFNA | 375-95-1-EIS | 273 | 109 | 250 | 267 | 107 | 50 - 150 | 250 | 261 | 104 | NA | NA |
| MPFBA | 375-22-4-EIS | 260 | 104 | 250 | 256 | 102 | 50 - 150 | 250 | 254 | 102 | NA | NA |
| MPFDoA | 307-55-1-EIS | 267 | 107 | 250 | 258 | 103 | 50 - 150 | 250 | 265 | 106 | NA | NA |
| MPFOA | 335-67-1-SUR | 561 | 112 | 500 | 556 | 111 | 50 - 150 | 500 | 560 | 112 | NA | NA |

# Top Assay Pre/Post Summary

| **Client ID** | CMT-VRTB-01_7_04152022 | | | | CMT-VRTB-01_6_04152022 | | | |
|---|---|---|---|---|---|---|---|---|
| **LAB ID** | 22204192001 | | | | 22204192004 | | | |
| **Collected** | 04/15/22 08:20 | | | | 04/15/22 09:05 | | | |
| **Matrix** | Water | | | | Water | | | |
| **Units** | ng/L | | | | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 2.25U | 2.25U | 0 | 0 | 2.25U | 2.25U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10U | 0 | 0 | 3.10U | 3.10U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75U | 0 | 0 | 3.75U | 3.75U | 0 | 0 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65U | 0 | 0 | 2.65U | 2.65U | 0 | 0 |
| 9Cl-PF3ONS | 2.25U | 2.25U | 0 | 0 | 2.25U | 2.25U | 0 | 0 |
| ADONA | 2.15U | 2.15U | 0 | 0 | 2.15U | 2.15U | 0 | 0 |
| NEtFOSAA | 3.95U | 3.95U | 0 | 0 | 3.95U | 3.95U | 0 | 0 |
| NMeFOSAA | 2.25U | 2.25U | 0 | 0 | 2.25U | 2.25U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7U | 0 | 0 | 16.7U | 16.7U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 1.83J | 1.55U | -1.83 | 200 | 8.43J | 7.32J | -1.11 | 14.1 |
| Perfluorobutanoic acid (PFBA) | 3.80U | 3.80U | 0 | 0 | 16.3 | 68.5 | 52.2 | 123.1 |
| Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05U | 0 | 0 | 3.05U | 3.05U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 3.60U | 3.60U | 0 | 0 | 3.60U | 3.60U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25U | 0 | 0 | 3.25U | 3.25U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 3.05U | 3.05U | 0 | 0 | 4.27J | 3.98J | -0.29 | 7 |
| Perfluoroheptanoic acid (PFHpA) | 2.90U | 2.90U | 0 | 0 | 8.59J | 8.81J | 0.22 | 2.5 |
| Perfluorohexanesulfonic acid (PFHxS) | 23.9 | 24.9 | 1 | 4.1 | 128 | 131 | 3 | 2.3 |
| Perfluorohexanoic acid (PFHxA) | 2.35U | 5.34J | 5.34 | 200 | 21.8 | 68.8 | 47 | 103.8 |
| Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35U | 0 | 0 | 4.35U | 4.35U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 2.45U | 2.45U | 0 | 0 | 2.45U | 2.45U | 0 | 0 |
| Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85U | 0 | 0 | 1.85U | 1.85U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 9.01J | 7.15J | -1.86 | 23 | 76.9 | 74.8 | -2.1 | 2.8 |
| Perfluorooctanoic acid (PFOA) | 2.10U | 2.10U | 0 | 0 | 11.3 | 10.7 | -0.6 | 5.5 |
| Perfluoropentanesulfonic acid (PFPeS) | 2.55U | 2.55U | 0 | 0 | 11.2 | 10.7 | -0.5 | 4.6 |
| Perfluoropentanoic acid (PFPeA) | 2.20U | 3.02J | 3.02 | 200 | 19.2 | 63.9 | 44.7 | 107.6 |
| Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85U | 0 | 0 | 2.85U | 2.85U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08U | 0 | 0 | 3.08U | 3.08U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10U | 0 | 0 | 3.10U | 3.10U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| **Client ID** | CMT-VRTB-01_5_04152022 | | | | CMT-VRTB-01_4_04152022 | | | |
|---|---|---|---|---|---|---|---|---|
| **LAB ID** | 22204192005 | | | | 22204192006 | | | |
| **Collected** | 04/15/22 09:35 | | | | 04/15/22 10:15 | | | |
| **Matrix** | Water | | | | Water | | | |
| **Units** | ng/L | | | | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 2.25U | 2.25U | 0 | 0 | 2.25U | 2.25U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10U | 0 | 0 | 3.10U | 3.10U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75U | 0 | 0 | 3.75U | 3.75U | 0 | 0 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65U | 0 | 0 | 2.65U | 2.65U | 0 | 0 |
| 9Cl-PF3ONS | 2.25U | 2.25U | 0 | 0 | 2.25U | 2.25U | 0 | 0 |
| ADONA | 2.15U | 2.15U | 0 | 0 | 2.15U | 2.15U | 0 | 0 |
| NEtFOSAA | 3.95U | 3.95U | 0 | 0 | 3.95U | 3.95U | 0 | 0 |
| NMeFOSAA | 2.25U | 2.25U | 0 | 0 | 2.25U | 2.25U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7U | 0 | 0 | 16.7U | 16.7U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 8.13J | 7.44J | -0.69 | 8.9 | 8.38J | 7.71J | -0.67 | 8.3 |
| Perfluorobutanoic acid (PFBA) | 11.7 | 61.8 | 50.1 | 136.3 | 13.4 | 62.8 | 49.4 | 129.7 |
| Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05U | 0 | 0 | 3.05U | 3.05U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 3.60U | 3.60U | 0 | 0 | 3.60U | 3.60U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25U | 0 | 0 | 3.25U | 3.25U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 3.53J | 3.06J | -0.47 | 14.3 | 5.83J | 5.60J | -0.23 | 4 |
| Perfluoroheptanoic acid (PFHpA) | 9.86J | 10.5 | 0.64 | 6.3 | 11.7 | 13.4 | 1.7 | 13.5 |
| Perfluorohexanesulfonic acid (PFHxS) | 113 | 114 | 1 | 0.9 | 139 | 143 | 4 | 2.8 |
| Perfluorohexanoic acid (PFHxA) | 18.7 | 42.1 | 23.4 | 77 | 20.7 | 98.4 | 77.7 | 130.5 |
| Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35U | 0 | 0 | 4.35U | 4.35U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 2.45U | 2.45U | 0 | 0 | 3.57J | 3.82J | 0.25 | 6.8 |
| Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85U | 0 | 0 | 2.44J | 1.85U | -2.44 | 200 |
| Perfluorooctanesulfonic acid (PFOS) | 84.6 | 84.9 | 0.3 | 0.4 | 528 | 540 | 12 | 2.2 |
| Perfluorooctanoic acid (PFOA) | 12.1 | 11.9 | -0.2 | 1.7 | 15.9 | 15.8 | -0.1 | 0.6 |
| Perfluoropentanesulfonic acid (PFPeS) | 10.5 | 10.0 | -0.5 | 4.9 | 10.5 | 11.2 | 0.7 | 6.5 |
| Perfluoropentanoic acid (PFPeA) | 16.5 | 42.9 | 26.4 | 88.9 | 18.6 | 52.0 | 33.4 | 94.6 |
| Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85U | 0 | 0 | 2.85U | 2.85U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08U | 0 | 0 | 3.08U | 3.08U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10U | 0 | 0 | 3.10U | 3.10U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| **Client ID** | CMT-VRTB-01_3_04152022 | | | | CMT-VRTB-01_2_04152022 | | | |
|---|---|---|---|---|---|---|---|---|
| **LAB ID** | 22204192007 | | | | 22204192008 | | | |
| **Collected** | 04/15/22 10:45 | | | | 04/15/22 11:20 | | | |
| **Matrix** | Water | | | | Water | | | |
| **Units** | ng/L | | | | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 2.25U | 2.25U | 0 | 0 | 2.25U | 2.25U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10U | 0 | 0 | 3.10U | 3.10U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 9.85J | 3.75U | -9.85 | 200 | 90.2 | 3.75U | -90.2 | 200 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 6.94J | 2.65U | -6.94 | 200 | 24.4 | 2.65U | -24.4 | 200 |
| 9Cl-PF3ONS | 2.25U | 2.25U | 0 | 0 | 2.25U | 2.25U | 0 | 0 |
| ADONA | 2.15U | 2.15U | 0 | 0 | 2.15U | 2.15U | 0 | 0 |
| NEtFOSAA | 3.95U | 3.95U | 0 | 0 | 3.95U | 3.95U | 0 | 0 |
| NMeFOSAA | 2.25U | 2.25U | 0 | 0 | 2.25U | 2.25U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7U | 0 | 0 | 16.7U | 16.7U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 7.47J | 6.74J | -0.73 | 10.3 | 23.7 | 25.1 | 1.4 | 5.7 |
| Perfluorobutanoic acid (PFBA) | 14.3 | 53.1 | 38.8 | 115.1 | 32.9 | 299 | 266.1 | 160.3 |
| Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05U | 0 | 0 | 3.05U | 3.05U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 3.60U | 3.60U | 0 | 0 | 3.60U | 3.60U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25U | 0 | 0 | 3.25U | 3.25U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 10.5 | 9.77J | -0.73 | 7.2 | 112 | 121 | 9 | 7.7 |
| Perfluoroheptanoic acid (PFHpA) | 16.1 | 21.4 | 5.3 | 28.3 | 105 | 199 | 94 | 61.8 |
| Perfluorohexanesulfonic acid (PFHxS) | 231 | 235 | 4 | 1.7 | 2130 | 2450 | 320 | 14 |
| Perfluorohexanoic acid (PFHxA) | 26.1 | 295 | 268.9 | 167.5 | 183 | 4400 | 4217 | 184 |
| Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35U | 0 | 0 | 4.35U | 4.35U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 9.49J | 9.03J | -0.46 | 5 | 62.7 | 56.7 | -6 | 10.1 |
| Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85U | 0 | 0 | 2.08J | 1.85U | -2.08 | 200 |
| Perfluorooctanesulfonic acid (PFOS) | 1830 | 1830 | 0 | 0 | 22500 | 20500 | -2000 | 9.3 |
| Perfluorooctanoic acid (PFOA) | 22.9 | 24.7 | 1.8 | 7.6 | 194 | 228 | 34 | 16.1 |
| Perfluoropentanesulfonic acid (PFPeS) | 10.4 | 10.6 | 0.2 | 1.9 | 59.8 | 66.9 | 7.10000000000001 | 11.2 |
| Perfluoropentanoic acid (PFPeA) | 22.2 | 81.1 | 58.9 | 114 | 85.3 | 976 | 890.7 | 167.9 |
| Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85U | 0 | 0 | 2.85U | 2.85U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08U | 0 | 0 | 3.08U | 3.08U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10U | 0 | 0 | 3.10U | 3.10U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| **Client ID** | CMT-VRTB-01_1_04152022 | | | |
|---|---|---|---|---|
| **LAB ID** | 22204192009 | | | |
| **Collected** | 04/15/22 11:50 | | | |
| **Matrix** | Water | | | |
| **Units** | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 11Cl-PF3OUdS | 2.25U | 2.25U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75U | 0 | 0 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65U | 0 | 0 |
| 9Cl-PF3ONS | 2.25U | 2.25U | 0 | 0 |
| ADONA | 2.15U | 2.15U | 0 | 0 |
| NEtFOSAA | 3.95U | 3.95U | 0 | 0 |
| NMeFOSAA | 2.25U | 2.25U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 68.0 | 76.6 | 8.59999999999999 | 11.9 |
| Perfluorobutanoic acid (PFBA) | 34.4 | 40.9 | 6.5 | 17.3 |
| Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 3.60U | 3.60U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 10.1 | 11.1 | 1 | 9.4 |
| Perfluoroheptanoic acid (PFHpA) | 78.0 | 88.2 | 10.2 | 12.3 |
| Perfluorohexanesulfonic acid (PFHxS) | 38.1 | 42.7 | 4.6 | 11.4 |
| Perfluorohexanoic acid (PFHxA) | 62.2 | 126 | 63.8 | 67.8 |
| Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 2.45U | 2.45U | 0 | 0 |
| Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 190 | 204 | 14 | 7.1 |
| Perfluorooctanoic acid (PFOA) | 94.9 | 95.6 | 0.7 | 0.7 |
| Perfluoropentanesulfonic acid (PFPeS) | 2.55U | 2.55U | 0 | 0 |
| Perfluoropentanoic acid (PFPeA) | 82.2 | 101 | 18.8 | 20.5 |
| Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10U | 0 | 0 |

Chain of Custody

Pace Analytical
www.pacelabs.com

Workorder: XD16001 Workorder Name: ESTCP Vertebrae - Grayling Owner Received Date: 4/16/2022 Results Requested By: 4/29/2022

| Report To: | Subcontract To: |
|---|---|
| Kathy E. Smith | Project # |
| Pace Analytical | |
| 106 Vantage Point Drive | Pace Gulf Coast |
| Columbia SC, 29223 | 7979 Innovation Park Drive, |
| 803-227-2704 | Baton Rouge, LA 70820 |
| Kathy.Smith@pacelabs.com | |

| Item | Sample ID | Sample Type | Collect Date/Time | Lab ID | Matrix | Preserved Containers | Requested Analysis: TOP Assay | Requested Analysis: MS/MSD | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CMT-VRTB-01_7_04152022 | grab | 04/15/2022 @ 0820 | XD16001-016 | Aqueous | | x | x | 1,2,3 |
| 2 | CMT-VRTB-01_6_04152022 | grab | 04/15/2022 @ 0905 | XD16001-017 | Aqueous | | x | | 4 |
| 3 | CMT-VRTB-01_5_04152022 | grab | 04/15/2022 @ 0935 | XD16001-018 | Aqueous | | x | | 5 |
| 4 | CMT-VRTB-01_4_04152022 | grab | 04/15/2022 @ 1015 | XD16001-019 | Aqueous | | x | | 6 |
| 5 | CMT-VRTB-01_3_04152022 | grab | 04/15/2022 @ 1045 | XD16001-020 | Aqueous | | x | | 7 |
| 6 | CMT-VRTB-01_2_04152022 | grab | 04/15/2022 @ 1120 | XD16001-021 | Aqueous | | x | | 8 |
| 7 | CMT-VRTB-01_1_04152022 | grab | 04/15/2022 @ 1150 | XD16001-022 | Aqueous | | x | | 9 |
| 8 | | | | | | | | | |
| 9 | | | *****PLEASE ASK ABIGAIL TO REACH OUT TO NICK NIGRO WITH QUESTIONS******** | | | | | | |
| 10 | | | | | | | | | |

| Transfers | Released By | Date/Time | Reveived By | Date/Time | Comments |
|---|---|---|---|---|---|
| 1 | Kayson Meeks | 4.15.22 1800 | | | |
| 2 | FedEx 4-19-22 10:00 | | Doug McCune 4-19-22 10:00 | | 1663 3466 8760 1.5 EM |
| 3 | | | | | |

| Cooler Temperature on Receipt _____ °C | Custody Seal Y or N | Received on Ice Y or N | Sample Intact Y or N |
|---|---|---|---|

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document.
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Friday, June 17, 2016 11:01:34 AM FMT-ALL-C-002r

Client ID: 4367 - Pace Analytical Services
SDG: 222041920
PM: RWe

# SAMPLE RECEIVING CHECKLIST

| SAMPLE DELIVERY GROUP 222041920 | |
|---|---|
| **Client** **PM** RWe<br>4367 - Pace Analytical Services | **Transport Method**<br>FEDEX |
| **Profile Number**<br>294461 | **Received By**<br>McCune, Dodie N. |
| **Line Item(s)**<br>2 - Top Assay Water | **Receive Date(s)**<br>04/19/22 |

| CHECKLIST | YES | NO |
|---|---|---|
| Samples received with proper thermal preservation? | ☑ | ☐ |
| Radioactivity is <1600 cpm? If no, record cpm value in notes section. | ☑ | ☐ |
| COC relinquished and complete (including sampleIDs, collect times, and sampler)? | ☑ | ☐ |
| All containers received in good condition and within hold time? | ☑ | ☐ |
| All sample labels and containers received match the chain of custody? | ☑ | ☐ |
| Preservative added to any containers? | ☐ | ☑ |
| If received, was headspace for VOC water containers < 6mm? | ☑ | ☐ |
| Samples collected in containers provided by Pace Gulf Coast? | ☑ | ☐ |

**COOLERS**

| Airbill | Thermometer ID: E34 | Temp °C |
|---|---|---|
| 166334668760 | | 1.5 |

**DISCREPANCIES**

None

**LAB PRESERVATIONS**

None

**NOTES**

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP Vertebrae - Grayling

Project Number: 30027244.00003

Lot Number:**XD16001**

Date Completed:05/19/2022

05/26/2022 2:14 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: XD16001

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

For sample XD16001-011 sample matrix prevented full volume from being extracted, precluding method mandated bottle rinse. Elution solvent was aliquoted directly into the reservoir, rinsing the inside. Surrogate recovery may be adversely affected.

Surrogate recovery for the following sample(s) was outside control limits: XD16001-008, XD16001-010, XD16001-011, XD16001-012. Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

The laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for analytical batch 39067 exceeded acceptance criteria for the following analytes: 6:2 FTS.

The MS/MSD associated with samples XD16001-002, XD16001-015 had compounds recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: XD16001

Project Name: ESTCP Vertebrae - Grayling

Project Number: 30027244.00003

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | MW-VRTB-3_04132022 | Aqueous | 04/13/2022 1130 | 04/16/2022 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | 04/13/2022 1255 | 04/16/2022 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | 04/13/2022 1350 | 04/16/2022 |
| 004 | DUP-01_04132022 | Aqueous | 04/13/2022 | 04/16/2022 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | 04/13/2022 1515 | 04/16/2022 |
| 006 | MW-VRTB-1D_04132022 | Aqueous | 04/13/2022 1625 | 04/16/2022 |
| 007 | VRTB-L-M5_04132022 | Aqueous | 04/13/2022 1745 | 04/16/2022 |
| 008 | VRTB-L-06_04142022 | Aqueous | 04/14/2022 0900 | 04/16/2022 |
| 009 | VRTB-L-P7_04142022 | Aqueous | 04/14/2022 1020 | 04/16/2022 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | 04/14/2022 1120 | 04/16/2022 |
| 011 | VRTB-L-B1_04142022 | Aqueous | 04/14/2022 1325 | 04/16/2022 |
| 012 | VRTB-L-S2_04142022 | Aqueous | 04/14/2022 1445 | 04/16/2022 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | 04/14/2022 1530 | 04/16/2022 |
| 014 | VRTB-L-G4_04142022 | Aqueous | 04/15/2022 1630 | 04/16/2022 |
| 015 | DUP-02_04142022 | Aqueous | 04/15/2022 | 04/16/2022 |
| 016 | CMT-VRTB-01_7_04152022 | Aqueous | 04/15/2022 0820 | 04/16/2022 |
| 017 | CMT-VRTB-01_6_04152022 | Aqueous | 04/15/2022 0905 | 04/16/2022 |
| 018 | CMT-VRTB-01_5_04152022 | Aqueous | 04/15/2022 0935 | 04/16/2022 |
| 019 | CMT-VRTB-01_4_04152022 | Aqueous | 04/15/2022 1015 | 04/16/2022 |
| 020 | CMT-VRTB-01_3_04152022 | Aqueous | 04/15/2022 1045 | 04/16/2022 |
| 021 | CMT-VRTB-01_2_04152022 | Aqueous | 04/15/2022 1120 | 04/16/2022 |
| 022 | CMT-VRTB-01_1_04152022 | Aqueous | 04/15/2022 1150 | 04/16/2022 |

(22 samples)

# Detection Summary

## Arcadis U.S., Inc.

Lot Number: XD16001

Project Name: ESTCP Vertebrae - Grayling

Project Number: 30027244.00003

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | MW-VRTB-3_04132022 | Aqueous | PFBS | PFAS by ID | 4.0 | | ng/L | 10 |
| 001 | MW-VRTB-3_04132022 | Aqueous | PFHpS | PFAS by ID | 7.8 | | ng/L | 10 |
| 001 | MW-VRTB-3_04132022 | Aqueous | PFPeS | PFAS by ID | 3.7 | | ng/L | 10 |
| 001 | MW-VRTB-3_04132022 | Aqueous | PFHxS | PFAS by ID | 110 | | ng/L | 10 |
| 001 | MW-VRTB-3_04132022 | Aqueous | PFBA | PFAS by ID | 9.9 | | ng/L | 10 |
| 001 | MW-VRTB-3_04132022 | Aqueous | PFHpA | PFAS by ID | 7.2 | | ng/L | 10 |
| 001 | MW-VRTB-3_04132022 | Aqueous | PFHxA | PFAS by ID | 17 | | ng/L | 10 |
| 001 | MW-VRTB-3_04132022 | Aqueous | PFNA | PFAS by ID | 7.1 | | ng/L | 10 |
| 001 | MW-VRTB-3_04132022 | Aqueous | PFOA | PFAS by ID | 16 | | ng/L | 10 |
| 001 | MW-VRTB-3_04132022 | Aqueous | PFPeA | PFAS by ID | 9.4 | | ng/L | 10 |
| 001 | MW-VRTB-3_04132022 | Aqueous | PFOS | PFAS by ID | 530 | | ng/L | 12 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | 8:2 FTS | PFAS by ID | 18 | | ng/L | 14 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | 6:2 FTS | PFAS by ID | 49 | L | ng/L | 14 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | PFBS | PFAS by ID | 12 | | ng/L | 14 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | PFHpS | PFAS by ID | 69 | | ng/L | 14 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | PFPeS | PFAS by ID | 33 | | ng/L | 14 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | PFBA | PFAS by ID | 44 | | ng/L | 14 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | PFHpA | PFAS by ID | 97 | S | ng/L | 14 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | PFHxA | PFAS by ID | 130 | | ng/L | 14 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | PFNA | PFAS by ID | 56 | | ng/L | 14 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | PFOA | PFAS by ID | 170 | S | ng/L | 14 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | PFPeA | PFAS by ID | 110 | S | ng/L | 14 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | PFHxS | PFAS by ID | 1100 | | ng/L | 16 |
| 002 | MW-VRTB-2S_04132022 | Aqueous | PFOS | PFAS by ID | 11000 | | ng/L | 16 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | PFBS | PFAS by ID | 12 | | ng/L | 18 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | PFHpS | PFAS by ID | 18 | | ng/L | 18 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | PFPeS | PFAS by ID | 17 | | ng/L | 18 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | PFHxS | PFAS by ID | 300 | | ng/L | 18 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | PFBA | PFAS by ID | 12 | | ng/L | 18 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | PFHpA | PFAS by ID | 10 | | ng/L | 18 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | PFHxA | PFAS by ID | 21 | | ng/L | 18 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | PFNA | PFAS by ID | 1.5 | J | ng/L | 18 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | PFOA | PFAS by ID | 47 | | ng/L | 18 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | PFPeA | PFAS by ID | 19 | | ng/L | 18 |
| 003 | MW-VRTB-2D_04132022 | Aqueous | PFOS | PFAS by ID | 320 | | ng/L | 18 |
| 004 | DUP-01_04132022 | Aqueous | PFBS | PFAS by ID | 2.2 | J | ng/L | 20 |
| 004 | DUP-01_04132022 | Aqueous | PFHpS | PFAS by ID | 1.6 | J | ng/L | 20 |
| 004 | DUP-01_04132022 | Aqueous | PFPeS | PFAS by ID | 1.3 | J | ng/L | 20 |
| 004 | DUP-01_04132022 | Aqueous | PFHxS | PFAS by ID | 47 | | ng/L | 20 |
| 004 | DUP-01_04132022 | Aqueous | PFBA | PFAS by ID | 10 | | ng/L | 20 |
| 004 | DUP-01_04132022 | Aqueous | PFHpA | PFAS by ID | 17 | | ng/L | 20 |
| 004 | DUP-01_04132022 | Aqueous | PFHxA | PFAS by ID | 16 | | ng/L | 20 |
| 004 | DUP-01_04132022 | Aqueous | PFNA | PFAS by ID | 1.8 | J | ng/L | 20 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 004 | DUP-01_04132022 | Aqueous | PFOA | PFAS by ID | 12 | | ng/L | 20 |
| 004 | DUP-01_04132022 | Aqueous | PFPeA | PFAS by ID | 20 | | ng/L | 20 |
| 004 | DUP-01_04132022 | Aqueous | PFOS | PFAS by ID | 110 | | ng/L | 20 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | 8:2 FTS | PFAS by ID | 66 | | ng/L | 22 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | 6:2 FTS | PFAS by ID | 270 | L | ng/L | 22 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | PFBS | PFAS by ID | 19 | | ng/L | 22 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | PFHpS | PFAS by ID | 100 | | ng/L | 22 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | PFPeS | PFAS by ID | 53 | | ng/L | 22 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | PFBA | PFAS by ID | 45 | | ng/L | 22 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | PFHpA | PFAS by ID | 190 | | ng/L | 22 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | PFHxA | PFAS by ID | 200 | | ng/L | 22 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | PFNA | PFAS by ID | 100 | | ng/L | 22 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | PFPeA | PFAS by ID | 130 | | ng/L | 22 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | PFHxS | PFAS by ID | 2100 | | ng/L | 24 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | PFOA | PFAS by ID | 330 | J | ng/L | 24 |
| 005 | MW-VRTB-1S_04132022 | Aqueous | PFOS | PFAS by ID | 15000 | | ng/L | 24 |
| 006 | MW-VRTB-1D_04132022 | Aqueous | PFBS | PFAS by ID | 9.0 | | ng/L | 26 |
| 006 | MW-VRTB-1D_04132022 | Aqueous | PFHpS | PFAS by ID | 6.6 | | ng/L | 26 |
| 006 | MW-VRTB-1D_04132022 | Aqueous | PFPeS | PFAS by ID | 13 | | ng/L | 26 |
| 006 | MW-VRTB-1D_04132022 | Aqueous | PFHxS | PFAS by ID | 190 | | ng/L | 26 |
| 006 | MW-VRTB-1D_04132022 | Aqueous | PFBA | PFAS by ID | 13 | | ng/L | 26 |
| 006 | MW-VRTB-1D_04132022 | Aqueous | PFHpA | PFAS by ID | 12 | | ng/L | 26 |
| 006 | MW-VRTB-1D_04132022 | Aqueous | PFHxA | PFAS by ID | 24 | | ng/L | 26 |
| 006 | MW-VRTB-1D_04132022 | Aqueous | PFOA | PFAS by ID | 21 | | ng/L | 26 |
| 006 | MW-VRTB-1D_04132022 | Aqueous | PFPeA | PFAS by ID | 19 | | ng/L | 26 |
| 006 | MW-VRTB-1D_04132022 | Aqueous | PFOS | PFAS by ID | 180 | | ng/L | 26 |
| 007 | VRTB-L-M5_04132022 | Aqueous | 8:2 FTS | PFAS by ID | 40 | | ng/L | 30 |
| 007 | VRTB-L-M5_04132022 | Aqueous | PFBS | PFAS by ID | 6.4 | | ng/L | 30 |
| 007 | VRTB-L-M5_04132022 | Aqueous | PFHpS | PFAS by ID | 28 | | ng/L | 30 |
| 007 | VRTB-L-M5_04132022 | Aqueous | PFPeS | PFAS by ID | 9.9 | | ng/L | 30 |
| 007 | VRTB-L-M5_04132022 | Aqueous | PFBA | PFAS by ID | 22 | | ng/L | 30 |
| 007 | VRTB-L-M5_04132022 | Aqueous | PFHpA | PFAS by ID | 37 | | ng/L | 30 |
| 007 | VRTB-L-M5_04132022 | Aqueous | PFHxA | PFAS by ID | 43 | | ng/L | 30 |
| 007 | VRTB-L-M5_04132022 | Aqueous | PFNA | PFAS by ID | 31 | | ng/L | 30 |
| 007 | VRTB-L-M5_04132022 | Aqueous | PFOA | PFAS by ID | 65 | | ng/L | 30 |
| 007 | VRTB-L-M5_04132022 | Aqueous | PFPeA | PFAS by ID | 48 | | ng/L | 30 |
| 007 | VRTB-L-M5_04132022 | Aqueous | PFHxS | PFAS by ID | 390 | | ng/L | 32 |
| 007 | VRTB-L-M5_04132022 | Aqueous | PFOS | PFAS by ID | 7100 | | ng/L | 32 |
| 008 | VRTB-L-06_04142022 | Aqueous | 8:2 FTS | PFAS by ID | 30 | | ng/L | 34 |
| 008 | VRTB-L-06_04142022 | Aqueous | PFBS | PFAS by ID | 13 | | ng/L | 34 |
| 008 | VRTB-L-06_04142022 | Aqueous | PFHpS | PFAS by ID | 69 | | ng/L | 34 |
| 008 | VRTB-L-06_04142022 | Aqueous | PFPeS | PFAS by ID | 35 | | ng/L | 34 |
| 008 | VRTB-L-06_04142022 | Aqueous | PFBA | PFAS by ID | 59 | | ng/L | 34 |
| 008 | VRTB-L-06_04142022 | Aqueous | PFHpA | PFAS by ID | 170 | | ng/L | 34 |
| 008 | VRTB-L-06_04142022 | Aqueous | PFHxA | PFAS by ID | 210 | | ng/L | 34 |
| 008 | VRTB-L-06_04142022 | Aqueous | PFNA | PFAS by ID | 75 | | ng/L | 34 |
| 008 | VRTB-L-06_04142022 | Aqueous | PFOA | PFAS by ID | 250 | | ng/L | 34 |
| 008 | VRTB-L-06_04142022 | Aqueous | PFPeA | PFAS by ID | 180 | | ng/L | 34 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 008 | VRTB-L-06_04142022 | Aqueous | PFHxS | PFAS by ID | 1100 | | ng/L | 36 |
| 008 | VRTB-L-06_04142022 | Aqueous | PFOS | PFAS by ID | 13000 | | ng/L | 36 |
| 008 | VRTB-L-06_04142022 | Aqueous | 6:2 FTS | PFAS by ID | 110 | | ng/L | 38 |
| 009 | VRTB-L-P7_04142022 | Aqueous | 8:2 FTS | PFAS by ID | 32 | J | ng/L | 40 |
| 009 | VRTB-L-P7_04142022 | Aqueous | 6:2 FTS | PFAS by ID | 80 | | ng/L | 40 |
| 009 | VRTB-L-P7_04142022 | Aqueous | PFHpS | PFAS by ID | 59 | | ng/L | 40 |
| 009 | VRTB-L-P7_04142022 | Aqueous | PFPeS | PFAS by ID | 17 | J | ng/L | 40 |
| 009 | VRTB-L-P7_04142022 | Aqueous | PFHxS | PFAS by ID | 830 | | ng/L | 40 |
| 009 | VRTB-L-P7_04142022 | Aqueous | PFBA | PFAS by ID | 33 | J | ng/L | 40 |
| 009 | VRTB-L-P7_04142022 | Aqueous | PFHpA | PFAS by ID | 86 | | ng/L | 40 |
| 009 | VRTB-L-P7_04142022 | Aqueous | PFHxA | PFAS by ID | 93 | | ng/L | 40 |
| 009 | VRTB-L-P7_04142022 | Aqueous | PFNA | PFAS by ID | 46 | | ng/L | 40 |
| 009 | VRTB-L-P7_04142022 | Aqueous | PFOA | PFAS by ID | 150 | | ng/L | 40 |
| 009 | VRTB-L-P7_04142022 | Aqueous | PFPeA | PFAS by ID | 81 | | ng/L | 40 |
| 009 | VRTB-L-P7_04142022 | Aqueous | PFOS | PFAS by ID | 13000 | | ng/L | 42 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | 8:2 FTS | PFAS by ID | 20 | | ng/L | 44 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | 6:2 FTS | PFAS by ID | 36 | | ng/L | 44 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | PFBS | PFAS by ID | 11 | | ng/L | 44 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | PFHpS | PFAS by ID | 46 | | ng/L | 44 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | PFPeS | PFAS by ID | 21 | | ng/L | 44 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | PFBA | PFAS by ID | 32 | | ng/L | 44 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | PFHpA | PFAS by ID | 65 | | ng/L | 44 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | PFHxA | PFAS by ID | 83 | | ng/L | 44 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | PFNA | PFAS by ID | 41 | Q | ng/L | 44 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | PFOA | PFAS by ID | 110 | | ng/L | 44 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | PFPeA | PFAS by ID | 74 | | ng/L | 44 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | PFHxS | PFAS by ID | 480 | | ng/L | 46 |
| 010 | VRTB-L-BB8_04142022 | Aqueous | PFOS | PFAS by ID | 6400 | | ng/L | 46 |
| 011 | VRTB-L-B1_04142022 | Aqueous | 8:2 FTS | PFAS by ID | 5.2 | J | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | 6:2 FTS | PFAS by ID | 4.9 | J | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | PFBS | PFAS by ID | 11 | | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | PFHpS | PFAS by ID | 18 | | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | PFPeS | PFAS by ID | 23 | | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | PFHxS | PFAS by ID | 320 | | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | PFBA | PFAS by ID | 14 | | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | PFHpA | PFAS by ID | 20 | | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | PFHxA | PFAS by ID | 34 | | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | PFNA | PFAS by ID | 13 | | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | PFOA | PFAS by ID | 54 | | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | PFPeA | PFAS by ID | 24 | | ng/L | 48 |
| 011 | VRTB-L-B1_04142022 | Aqueous | PFOS | PFAS by ID | 1400 | | ng/L | 50 |
| 012 | VRTB-L-S2_04142022 | Aqueous | 8:2 FTS | PFAS by ID | 5.4 | J | ng/L | 52 |
| 012 | VRTB-L-S2_04142022 | Aqueous | 6:2 FTS | PFAS by ID | 2.0 | J | ng/L | 52 |
| 012 | VRTB-L-S2_04142022 | Aqueous | PFBS | PFAS by ID | 10 | | ng/L | 52 |
| 012 | VRTB-L-S2_04142022 | Aqueous | PFHpS | PFAS by ID | 11 | | ng/L | 52 |
| 012 | VRTB-L-S2_04142022 | Aqueous | PFPeS | PFAS by ID | 16 | | ng/L | 52 |
| 012 | VRTB-L-S2_04142022 | Aqueous | PFHxS | PFAS by ID | 210 | | ng/L | 52 |
| 012 | VRTB-L-S2_04142022 | Aqueous | PFBA | PFAS by ID | 10 | | ng/L | 52 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 012 | VRTB-L-S2_04142022 | Aqueous | PFHpA | PFAS by ID | 10 | | ng/L | 52 |
| 012 | VRTB-L-S2_04142022 | Aqueous | PFHxA | PFAS by ID | 24 | | ng/L | 52 |
| 012 | VRTB-L-S2_04142022 | Aqueous | PFNA | PFAS by ID | 3.1 | J | ng/L | 52 |
| 012 | VRTB-L-S2_04142022 | Aqueous | PFOA | PFAS by ID | 33 | | ng/L | 52 |
| 012 | VRTB-L-S2_04142022 | Aqueous | PFPeA | PFAS by ID | 14 | | ng/L | 52 |
| 012 | VRTB-L-S2_04142022 | Aqueous | PFOS | PFAS by ID | 670 | | ng/L | 54 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | 8:2 FTS | PFAS by ID | 69 | | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | 6:2 FTS | PFAS by ID | 42 | | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFBS | PFAS by ID | 16 | | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFHpS | PFAS by ID | 100 | | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFOSA | PFAS by ID | 1.0 | J | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFPeS | PFAS by ID | 41 | | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFBA | PFAS by ID | 50 | | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFHpA | PFAS by ID | 110 | | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFHxA | PFAS by ID | 200 | | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFNA | PFAS by ID | 44 | | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFOA | PFAS by ID | 150 | | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFPeA | PFAS by ID | 110 | | ng/L | 58 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFHxS | PFAS by ID | 1200 | | ng/L | 60 |
| 013 | VRTB-L-Y3_04142022 | Aqueous | PFOS | PFAS by ID | 4400 | | ng/L | 60 |
| 014 | VRTB-L-G4_04142022 | Aqueous | 8:2 FTS | PFAS by ID | 18 | | ng/L | 62 |
| 014 | VRTB-L-G4_04142022 | Aqueous | 6:2 FTS | PFAS by ID | 28 | | ng/L | 62 |
| 014 | VRTB-L-G4_04142022 | Aqueous | PFBS | PFAS by ID | 23 | | ng/L | 62 |
| 014 | VRTB-L-G4_04142022 | Aqueous | PFHpS | PFAS by ID | 17 | | ng/L | 62 |
| 014 | VRTB-L-G4_04142022 | Aqueous | PFPeS | PFAS by ID | 34 | | ng/L | 62 |
| 014 | VRTB-L-G4_04142022 | Aqueous | PFBA | PFAS by ID | 40 | | ng/L | 62 |
| 014 | VRTB-L-G4_04142022 | Aqueous | PFHpA | PFAS by ID | 91 | | ng/L | 62 |
| 014 | VRTB-L-G4_04142022 | Aqueous | PFHxA | PFAS by ID | 170 | | ng/L | 62 |
| 014 | VRTB-L-G4_04142022 | Aqueous | PFNA | PFAS by ID | 7.8 | | ng/L | 62 |
| 014 | VRTB-L-G4_04142022 | Aqueous | PFOA | PFAS by ID | 70 | | ng/L | 62 |
| 014 | VRTB-L-G4_04142022 | Aqueous | PFPeA | PFAS by ID | 120 | | ng/L | 62 |
| 014 | VRTB-L-G4_04142022 | Aqueous | PFHxS | PFAS by ID | 610 | | ng/L | 64 |
| 014 | VRTB-L-G4_04142022 | Aqueous | PFOS | PFAS by ID | 1200 | | ng/L | 64 |
| 015 | DUP-02_04142022 | Aqueous | 8:2 FTS | PFAS by ID | 18 | | ng/L | 66 |
| 015 | DUP-02_04142022 | Aqueous | 6:2 FTS | PFAS by ID | 27 | | ng/L | 66 |
| 015 | DUP-02_04142022 | Aqueous | PFBS | PFAS by ID | 23 | | ng/L | 66 |
| 015 | DUP-02_04142022 | Aqueous | PFHpS | PFAS by ID | 17 | | ng/L | 66 |
| 015 | DUP-02_04142022 | Aqueous | PFPeS | PFAS by ID | 35 | S | ng/L | 66 |
| 015 | DUP-02_04142022 | Aqueous | PFBA | PFAS by ID | 41 | | ng/L | 66 |
| 015 | DUP-02_04142022 | Aqueous | PFHpA | PFAS by ID | 88 | S | ng/L | 66 |
| 015 | DUP-02_04142022 | Aqueous | PFHxA | PFAS by ID | 170 | S | ng/L | 66 |
| 015 | DUP-02_04142022 | Aqueous | PFNA | PFAS by ID | 7.5 | | ng/L | 66 |
| 015 | DUP-02_04142022 | Aqueous | PFOA | PFAS by ID | 74 | S | ng/L | 66 |
| 015 | DUP-02_04142022 | Aqueous | PFPeA | PFAS by ID | 120 | S | ng/L | 66 |
| 015 | DUP-02_04142022 | Aqueous | PFHxS | PFAS by ID | 600 | S | ng/L | 68 |
| 015 | DUP-02_04142022 | Aqueous | PFOS | PFAS by ID | 1200 | S | ng/L | 68 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|

(185 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-001

Description: MW-VRTB-3_04132022 | Matrix: Aqueous

Date Sampled: 04/13/2022 1130 | Project Name: ESTCP Vertebrae - Grayling

Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2021 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 05/02/2022 2338 | NK1 | 04/22/2022 1218 | 39067 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UL | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.0 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.8 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 3.7 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 110 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 9.9 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 7.2 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 17 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.1 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 16 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 9.4 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 570 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 110 | 50-150 | | 97 | 50-150 |
| 13C2_6:2FTS | | 102 | 50-150 | | 102 | 50-150 |
| 13C2_8:2FTS | | 95 | 50-150 | | 86 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 | | 87 | 50-150 |
| 13C2_PFTeDA | | 88 | 50-150 | | 86 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 | | 86 | 50-150 |
| 13C3_PFHxS | | 90 | 50-150 | | 86 | 50-150 |
| 13C4_PFBA | | 85 | 50-150 | | 92 | 50-150 |
| 13C4_PFHpA | | 89 | 50-150 | | 88 | 50-150 |
| 13C5_PFHxA | | 86 | 50-150 | | 88 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 | | 89 | 50-150 |
| 13C6_PFDA | | 85 | 50-150 | | 89 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 | | 85 | 50-150 |
| 13C8_PFOA | | 91 | 50-150 | | 91 | 50-150 |
| 13C8_PFOS | | 84 | 50-150 | | 87 | 50-150 |
| 13C8_PFOSA | | 96 | 50-150 | | 87 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-001
Description: MW-VRTB-3_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1130
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 86 | 50-150 | | 90 | 50-150 |
| d5-EtFOSAA | | 86 | 50-150 | | 87 | 50-150 |
| d-MeFOSA | | 75 | 50-150 | | 67 | 50-150 |
| d3-MeFOSAA | | 90 | 50-150 | | 74 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-001
Description: MW-VRTB-3_04132022 | Matrix: Aqueous
Date Sampled: 04/13/2022 1130 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2021 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 05/02/2022 2338 | NK1 | 04/22/2022 1218 | 39067 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 17 | UL | 34 | 17 | 8.6 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.3 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 8.2 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 110 | | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 9.8 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 8.3 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 17 | | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.0 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 17 | | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 9.4 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 530 | | 17 | 8.5 | 4.3 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 110 | 50-150 | | 97 | 50-150 |
| 13C2_6:2FTS | | 102 | 50-150 | | 102 | 50-150 |
| 13C2_8:2FTS | | 95 | 50-150 | | 86 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 | | 87 | 50-150 |
| 13C2_PFTeDA | | 88 | 50-150 | | 86 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 | | 86 | 50-150 |
| 13C3_PFHxS | | 90 | 50-150 | | 86 | 50-150 |
| 13C4_PFBA | | 85 | 50-150 | | 92 | 50-150 |
| 13C4_PFHpA | | 89 | 50-150 | | 88 | 50-150 |
| 13C5_PFHxA | | 86 | 50-150 | | 88 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 | | 89 | 50-150 |
| 13C6_PFDA | | 85 | 50-150 | | 89 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 | | 85 | 50-150 |
| 13C8_PFOA | | 91 | 50-150 | | 91 | 50-150 |
| 13C8_PFOS | | 84 | 50-150 | | 87 | 50-150 |
| 13C8_PFOSA | | 96 | 50-150 | | 87 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-001
Description: MW-VRTB-3_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1130
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 86 | 50-150 | | 90 | 50-150 |
| d5-EtFOSAA | | 86 | 50-150 | | 87 | 50-150 |
| d-MeFOSA | | 75 | 50-150 | | 67 | 50-150 |
| d3-MeFOSAA | | 90 | 50-150 | | 74 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-002
Description: MW-VRTB-2S_04132022 | Matrix: Aqueous
Date Sampled: 04/13/2022 1255 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2032 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 05/02/2022 2348 | NK1 | 04/22/2022 1218 | 39067 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 18 | | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 49 | L | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 12 | | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | US | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 69 | | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | US | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 33 | | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1200 | ES | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 44 | | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 97 | S | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 130 | | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 56 | | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 170 | S | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 110 | S | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 11000 | ES | 3.5 | 1.8 | 0.89 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 | | 113 | 50-150 |
| 13C2_6:2FTS | | 96 | 50-150 | | 115 | 50-150 |
| 13C2_8:2FTS | | 92 | 50-150 | | 115 | 50-150 |
| 13C2_PFDoA | | 91 | 50-150 | | 116 | 50-150 |
| 13C2_PFTeDA | | 86 | 50-150 | | 114 | 50-150 |
| 13C3_PFBS | | 96 | 50-150 | | 106 | 50-150 |
| 13C3_PFHxS | | 79 | 50-150 | | 116 | 50-150 |
| 13C4_PFBA | | 85 | 50-150 | | 115 | 50-150 |
| 13C4_PFHpA | | 81 | 50-150 | | 120 | 50-150 |
| 13C5_PFHxA | | 90 | 50-150 | | 111 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | | 112 | 50-150 |
| 13C6_PFDA | | 82 | 50-150 | | 115 | 50-150 |
| 13C7_PFUdA | | 90 | 50-150 | | 112 | 50-150 |
| 13C8_PFOA | | 86 | 50-150 | | 113 | 50-150 |
| 13C8_PFOS | | 53 | 50-150 | | 107 | 50-150 |
| 13C8_PFOSA | | 95 | 50-150 | | 114 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-002
Description: MW-VRTB-2S_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1255
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 60 | 50-150 | | 113 | 50-150 |
| d5-EtFOSAA | | 88 | 50-150 | | 116 | 50-150 |
| d-MeFOSA | | 78 | 50-150 | | 112 | 50-150 |
| d3-MeFOSAA | | 89 | 50-150 | | 100 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-002
Description: MW-VRTB-2S_04132022 | Matrix: Aqueous
Date Sampled: 04/13/2022 1255 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2032 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 05/02/2022 2348 | NK1 | 04/22/2022 1218 | 39067 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 360 | U | 710 | 360 | 180 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 360 | UL | 710 | 360 | 180 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 360 | U | 710 | 360 | 180 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 360 | U | 710 | 360 | 180 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 700 | U | 1400 | 700 | 350 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 360 | U | 710 | 360 | 180 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1100 | | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 99 | J | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 120 | J | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 130 | J | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 99 | J | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 180 | U | 350 | 180 | 89 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 11000 | | 350 | 180 | 89 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 | | 113 | 50-150 |
| 13C2_6:2FTS | | 96 | 50-150 | | 115 | 50-150 |
| 13C2_8:2FTS | | 92 | 50-150 | | 115 | 50-150 |
| 13C2_PFDoA | | 91 | 50-150 | | 116 | 50-150 |
| 13C2_PFTeDA | | 86 | 50-150 | | 114 | 50-150 |
| 13C3_PFBS | | 96 | 50-150 | | 106 | 50-150 |
| 13C3_PFHxS | | 79 | 50-150 | | 116 | 50-150 |
| 13C4_PFBA | | 85 | 50-150 | | 115 | 50-150 |
| 13C4_PFHpA | | 81 | 50-150 | | 120 | 50-150 |
| 13C5_PFHxA | | 90 | 50-150 | | 111 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | | 112 | 50-150 |
| 13C6_PFDA | | 82 | 50-150 | | 115 | 50-150 |
| 13C7_PFUdA | | 90 | 50-150 | | 112 | 50-150 |
| 13C8_PFOA | | 86 | 50-150 | | 113 | 50-150 |
| 13C8_PFOS | | 53 | 50-150 | | 107 | 50-150 |
| 13C8_PFOSA | | 95 | 50-150 | | 114 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-002
Description: MW-VRTB-2S_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1255
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 60 | 50-150 | | 113 | 50-150 |
| d5-EtFOSAA | | 88 | 50-150 | | 116 | 50-150 |
| d-MeFOSA | | 78 | 50-150 | | 112 | 50-150 |
| d3-MeFOSAA | | 89 | 50-150 | | 100 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-003
Description: MW-VRTB-2D_04132022 | Matrix: Aqueous
Date Sampled: 04/13/2022 1350 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2054 | ASD | 04/22/2022 1218 | 39067 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UL | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 12 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 18 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 17 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 300 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 12 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 10 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 21 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.5 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 47 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 19 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 320 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 92 | 50-150 |
| 13C2_6:2FTS | | 94 | 50-150 |
| 13C2_8:2FTS | | 91 | 50-150 |
| 13C2_PFDoA | | 83 | 50-150 |
| 13C2_PFTeDA | | 83 | 50-150 |
| 13C3_PFBS | | 87 | 50-150 |
| 13C3_PFHxS | | 82 | 50-150 |
| 13C4_PFBA | | 85 | 50-150 |
| 13C4_PFHpA | | 83 | 50-150 |
| 13C5_PFHxA | | 83 | 50-150 |
| 13C5_PFPeA | | 84 | 50-150 |
| 13C6_PFDA | | 80 | 50-150 |
| 13C7_PFUdA | | 84 | 50-150 |
| 13C8_PFOA | | 83 | 50-150 |
| 13C8_PFOS | | 83 | 50-150 |
| 13C8_PFOSA | | 87 | 50-150 |
| 13C9_PFNA | | 85 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XD16001-003 |
| Description: MW-VRTB-2D_04132022 | | | Matrix: Aqueous |
| Date Sampled: 04/13/2022 1350 | Project Name: ESTCP Vertebrae - Grayling | | |
| Date Received: 04/16/2022 | Project Number: 30027244.00003 | | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 83 | 50-150 |
| d-MeFOSA | | 68 | 50-150 |
| d3-MeFOSAA | | 85 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-004
Description: DUP-01_04132022 | Matrix: Aqueous
Date Sampled: 04/13/2022 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2105 | ASD | 04/22/2022 1218 | 39067 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.1 | UL | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.2 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.6 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.3 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 47 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 10 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 17 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 16 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 12 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 20 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 110 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 |
| 13C2_6:2FTS | | 109 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 |
| 13C2_PFDoA | | 80 | 50-150 |
| 13C2_PFTeDA | | 66 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 |
| 13C4_PFHpA | | 90 | 50-150 |
| 13C5_PFHxA | | 89 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 |
| 13C6_PFDA | | 82 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |
| 13C8_PFOS | | 88 | 50-150 |
| 13C8_PFOSA | | 94 | 50-150 |
| 13C9_PFNA | | 91 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XD16001-004 |
| Description: DUP-01_04132022 | | | Matrix: Aqueous |
| Date Sampled: 04/13/2022 | Project Name: ESTCP Vertebrae - Grayling | | |
| Date Received: 04/16/2022 | Project Number: 30027244.00003 | | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 88 | 50-150 |
| d-MeFOSA | | 72 | 50-150 |
| d3-MeFOSAA | | 89 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-005
Description: MW-VRTB-1S_04132022 | Matrix: Aqueous
Date Sampled: 04/13/2022 1515 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2116 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 05/03/2022 0021 | NK1 | 04/22/2022 1218 | 39067 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 66 | | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 270 | L | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.6 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 19 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 100 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 53 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 2200 | E | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 45 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 190 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 200 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 100 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 370 | E | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 130 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 15000 | E | 3.6 | 1.8 | 0.89 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 | | 106 | 50-150 |
| 13C2_6:2FTS | | 93 | 50-150 | | 112 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 | | 107 | 50-150 |
| 13C2_PFDoA | | 96 | 50-150 | | 105 | 50-150 |
| 13C2_PFTeDA | | 92 | 50-150 | | 103 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 | | 102 | 50-150 |
| 13C3_PFHxS | | 74 | 50-150 | | 108 | 50-150 |
| 13C4_PFBA | | 88 | 50-150 | | 107 | 50-150 |
| 13C4_PFHpA | | 80 | 50-150 | | 108 | 50-150 |
| 13C5_PFHxA | | 89 | 50-150 | | 101 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 | | 104 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 | | 104 | 50-150 |
| 13C7_PFUdA | | 95 | 50-150 | | 98 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 | | 103 | 50-150 |
| 13C8_PFOS | | 51 | 50-150 | | 103 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 | | 106 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-005
Description: MW-VRTB-1S_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1515
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 53 | 50-150 | | 105 | 50-150 |
| d5-EtFOSAA | | 94 | 50-150 | | 104 | 50-150 |
| d-MeFOSA | | 85 | 50-150 | | 106 | 50-150 |
| d3-MeFOSAA | | 107 | 50-150 | | 95 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-005

Description: MW-VRTB-1S_04132022 | Matrix: Aqueous

Date Sampled: 04/13/2022 1515 | Project Name: ESTCP Vertebrae - Grayling

Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2116 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 05/03/2022 0021 | NK1 | 04/22/2022 1218 | 39067 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 360 | U | 710 | 360 | 180 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 230 | JL | 710 | 360 | 180 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 360 | U | 710 | 360 | 180 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 360 | U | 710 | 360 | 180 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 700 | U | 1400 | 700 | 360 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 360 | U | 710 | 360 | 180 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 2100 | | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 200 | J | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 190 | J | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 110 | J | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 330 | J | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 140 | J | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 180 | U | 360 | 180 | 89 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 15000 | | 360 | 180 | 89 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 | | 106 | 50-150 |
| 13C2_6:2FTS | | 93 | 50-150 | | 112 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 | | 107 | 50-150 |
| 13C2_PFDoA | | 96 | 50-150 | | 105 | 50-150 |
| 13C2_PFTeDA | | 92 | 50-150 | | 103 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 | | 102 | 50-150 |
| 13C3_PFHxS | | 74 | 50-150 | | 108 | 50-150 |
| 13C4_PFBA | | 88 | 50-150 | | 107 | 50-150 |
| 13C4_PFHpA | | 80 | 50-150 | | 108 | 50-150 |
| 13C5_PFHxA | | 89 | 50-150 | | 101 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 | | 104 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 | | 104 | 50-150 |
| 13C7_PFUdA | | 95 | 50-150 | | 98 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 | | 103 | 50-150 |
| 13C8_PFOS | | 51 | 50-150 | | 103 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 | | 106 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-005
Description: MW-VRTB-1S_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1515
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 53 | 50-150 | | 105 | 50-150 |
| d5-EtFOSAA | | 94 | 50-150 | | 104 | 50-150 |
| d-MeFOSA | | 85 | 50-150 | | 106 | 50-150 |
| d3-MeFOSAA | | 107 | 50-150 | | 95 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-006
Description: MW-VRTB-1D_04132022 | Matrix: Aqueous
Date Sampled: 04/13/2022 1625 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2137 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/09/2022 1102 | MMM | 05/04/2022 1353 | 40323 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 18 | L | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.6 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.0 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 6.6 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 13 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 190 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 13 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 12 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 24 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 21 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 19 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 180 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 92 | 50-150 | | 107 | 50-150 |
| 13C2_6:2FTS | | 92 | 50-150 | | 138 | 50-150 |
| 13C2_8:2FTS | | 88 | 50-150 | | 104 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 | | 90 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 | | 94 | 50-150 |
| 13C3_PFBS | | 92 | 50-150 | | 99 | 50-150 |
| 13C3_PFHxS | | 88 | 50-150 | | 97 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 | | 99 | 50-150 |
| 13C4_PFHpA | | 84 | 50-150 | | 96 | 50-150 |
| 13C5_PFHxA | | 84 | 50-150 | | 99 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | | 96 | 50-150 |
| 13C6_PFDA | | 80 | 50-150 | | 102 | 50-150 |
| 13C7_PFUdA | | 86 | 50-150 | | 98 | 50-150 |
| 13C8_PFOA | | 89 | 50-150 | | 107 | 50-150 |
| 13C8_PFOS | | 89 | 50-150 | | 99 | 50-150 |
| 13C8_PFOSA | | 91 | 50-150 | | 114 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-006
Description: MW-VRTB-1D_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1625
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 90 | 50-150 | | 93 | 50-150 |
| d5-EtFOSAA | | 85 | 50-150 | | 99 | 50-150 |
| d-MeFOSA | | 79 | 50-150 | | 77 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 | | 95 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-006
Description: MW-VRTB-1D_04132022 | Matrix: Aqueous
Date Sampled: 04/13/2022 1625 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2137 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/09/2022 1102 | MMM | 05/04/2022 1353 | 40323 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 8.4 | | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.1 | | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.2 | J | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 12 | | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 190 | | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 12 | | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 11 | | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 19 | | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 17 | | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 180 | | 3.4 | 1.7 | 0.86 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 92 | 50-150 | | 107 | 50-150 |
| 13C2_6:2FTS | | 92 | 50-150 | | 138 | 50-150 |
| 13C2_8:2FTS | | 88 | 50-150 | | 104 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 | | 90 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 | | 94 | 50-150 |
| 13C3_PFBS | | 92 | 50-150 | | 99 | 50-150 |
| 13C3_PFHxS | | 88 | 50-150 | | 97 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 | | 99 | 50-150 |
| 13C4_PFHpA | | 84 | 50-150 | | 96 | 50-150 |
| 13C5_PFHxA | | 84 | 50-150 | | 99 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | | 96 | 50-150 |
| 13C6_PFDA | | 80 | 50-150 | | 102 | 50-150 |
| 13C7_PFUdA | | 86 | 50-150 | | 98 | 50-150 |
| 13C8_PFOA | | 89 | 50-150 | | 107 | 50-150 |
| 13C8_PFOS | | 89 | 50-150 | | 99 | 50-150 |
| 13C8_PFOSA | | 91 | 50-150 | | 114 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-006
Description: MW-VRTB-1D_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1625
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 90 | 50-150 | | 93 | 50-150 |
| d5-EtFOSAA | | 85 | 50-150 | | 99 | 50-150 |
| d-MeFOSA | | 79 | 50-150 | | 77 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 | | 95 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-007
Description: VRTB-L-M5_04132022 | Matrix: Aqueous
Date Sampled: 04/13/2022 1745 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2148 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 50 | 05/03/2022 0043 | NK1 | 04/22/2022 1218 | 39067 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 40 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 38 | L | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 6.4 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 28 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 9.9 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 370 | E | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 22 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 37 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 43 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 31 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 65 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 48 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 6700 | E | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 109 | 50-150 | | 111 | 50-150 |
| 13C2_6:2FTS | | 102 | 50-150 | | 113 | 50-150 |
| 13C2_8:2FTS | | 92 | 50-150 | | 106 | 50-150 |
| 13C2_PFDoA | | 83 | 50-150 | | 106 | 50-150 |
| 13C2_PFTeDA | | 55 | 50-150 | | 105 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 | | 103 | 50-150 |
| 13C3_PFHxS | | 87 | 50-150 | | 108 | 50-150 |
| 13C4_PFBA | | 80 | 50-150 | | 107 | 50-150 |
| 13C4_PFHpA | | 86 | 50-150 | | 108 | 50-150 |
| 13C5_PFHxA | | 90 | 50-150 | | 99 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 | | 103 | 50-150 |
| 13C6_PFDA | | 82 | 50-150 | | 106 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 | | 101 | 50-150 |
| 13C8_PFOA | | 84 | 50-150 | | 107 | 50-150 |
| 13C8_PFOS | | 61 | 50-150 | | 102 | 50-150 |
| 13C8_PFOSA | | 92 | 50-150 | | 109 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-007
Description: VRTB-L-M5_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1745
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 66 | 50-150 | | 103 | 50-150 |
| d5-EtFOSAA | | 91 | 50-150 | | 106 | 50-150 |
| d-MeFOSA | | 71 | 50-150 | | 105 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 | | 96 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-007
Description: VRTB-L-M5_04132022 | Matrix: Aqueous
Date Sampled: 04/13/2022 1745 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2148 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 50 | 05/03/2022 0043 | NK1 | 04/22/2022 1218 | 39067 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 180 | U | 350 | 180 | 87 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 180 | UL | 350 | 180 | 87 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 180 | U | 350 | 180 | 87 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 180 | U | 350 | 180 | 87 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 350 | U | 690 | 350 | 170 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 180 | U | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 390 | | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 44 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 60 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 83 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 57 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 7100 | | 170 | 85 | 43 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 109 | 50-150 | | 111 | 50-150 |
| 13C2_6:2FTS | | 102 | 50-150 | | 113 | 50-150 |
| 13C2_8:2FTS | | 92 | 50-150 | | 106 | 50-150 |
| 13C2_PFDoA | | 83 | 50-150 | | 106 | 50-150 |
| 13C2_PFTeDA | | 55 | 50-150 | | 105 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 | | 103 | 50-150 |
| 13C3_PFHxS | | 87 | 50-150 | | 108 | 50-150 |
| 13C4_PFBA | | 80 | 50-150 | | 107 | 50-150 |
| 13C4_PFHpA | | 86 | 50-150 | | 108 | 50-150 |
| 13C5_PFHxA | | 90 | 50-150 | | 99 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 | | 103 | 50-150 |
| 13C6_PFDA | | 82 | 50-150 | | 106 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 | | 101 | 50-150 |
| 13C8_PFOA | | 84 | 50-150 | | 107 | 50-150 |
| 13C8_PFOS | | 61 | 50-150 | | 102 | 50-150 |
| 13C8_PFOSA | | 92 | 50-150 | | 109 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-007
Description: VRTB-L-M5_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1745
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 66 | 50-150 | | 103 | 50-150 |
| d5-EtFOSAA | | 91 | 50-150 | | 106 | 50-150 |
| d-MeFOSA | | 71 | 50-150 | | 105 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 | | 96 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-008
Description: VRTB-L-06_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 0900 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2159 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 05/03/2022 0054 | NK1 | 04/22/2022 1218 | 39067 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/09/2022 1113 | MMM | 05/04/2022 1353 | 40323 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 30 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 130 | L | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 13 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 69 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 35 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1400 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 59 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 170 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 210 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 75 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 250 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 180 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 14000 | EQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 115 | 50-150 | | 143 | 50-150 | | 126 | 50-150 |
| 13C2_6:2FTS | | 103 | 50-150 | N | 159 | 50-150 | | 111 | 50-150 |
| 13C2_8:2FTS | | 97 | 50-150 | N | 151 | 50-150 | | 103 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 | N | 154 | 50-150 | | 96 | 50-150 |
| 13C2_PFTeDA | | 72 | 50-150 | N | 158 | 50-150 | | 76 | 50-150 |
| 13C3_PFBS | | 102 | 50-150 | | 144 | 50-150 | | 98 | 50-150 |
| 13C3_PFHxS | | 80 | 50-150 | | 146 | 50-150 | | 79 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 | N | 153 | 50-150 | | 91 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 | N | 154 | 50-150 | | 89 | 50-150 |
| 13C5_PFHxA | | 89 | 50-150 | | 146 | 50-150 | | 90 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 | | 149 | 50-150 | | 98 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 | | 149 | 50-150 | | 101 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 | | 145 | 50-150 | | 95 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 | | 149 | 50-150 | | 95 | 50-150 |
| 13C8_PFOS | N | 47 | 50-150 | | 146 | 50-150 | N | 37 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-008
Description: VRTB-L-06_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 0900
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 98 | 50-150 | N | 151 | 50-150 | | 112 | 50-150 |
| 13C9_PFNA | | 54 | 50-150 | | 148 | 50-150 | N | 39 | 50-150 |
| d5-EtFOSAA | | 89 | 50-150 | | 148 | 50-150 | | 98 | 50-150 |
| d-MeFOSA | | 83 | 50-150 | | 150 | 50-150 | | 76 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 | | 124 | 50-150 | | 98 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-008
Description: VRTB-L-06_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 0900 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2159 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 05/03/2022 0054 | NK1 | 04/22/2022 1218 | 39067 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/09/2022 1113 | MMM | 05/04/2022 1353 | 40323 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 350 | UQ | 690 | 350 | 170 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 350 | UQL | 690 | 350 | 170 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 350 | U | 690 | 350 | 170 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 350 | U | 690 | 350 | 170 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 700 | U | 1400 | 700 | 340 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 350 | U | 690 | 350 | 170 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 170 | UQ | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1100 | | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 170 | UQ | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 170 | UQ | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 150 | JQ | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 180 | J | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 210 | J | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 150 | J | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 170 | UQ | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 170 | UQ | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 13000 | | 340 | 170 | 86 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 115 | 50-150 | | 143 | 50-150 | | 126 | 50-150 |
| 13C2_6:2FTS | | 103 | 50-150 | N | 159 | 50-150 | | 111 | 50-150 |
| 13C2_8:2FTS | | 97 | 50-150 | N | 151 | 50-150 | | 103 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 | N | 154 | 50-150 | | 96 | 50-150 |
| 13C2_PFTeDA | | 72 | 50-150 | N | 158 | 50-150 | | 76 | 50-150 |
| 13C3_PFBS | | 102 | 50-150 | | 144 | 50-150 | | 98 | 50-150 |
| 13C3_PFHxS | | 80 | 50-150 | | 146 | 50-150 | | 79 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 | N | 153 | 50-150 | | 91 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 | N | 154 | 50-150 | | 89 | 50-150 |
| 13C5_PFHxA | | 89 | 50-150 | | 146 | 50-150 | | 90 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 | | 149 | 50-150 | | 98 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 | | 149 | 50-150 | | 101 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 | | 145 | 50-150 | | 95 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 | | 149 | 50-150 | | 95 | 50-150 |
| 13C8_PFOS | N | 47 | 50-150 | | 146 | 50-150 | N | 37 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-008
Description: VRTB-L-06_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 0900
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 98 | 50-150 | N | 151 | 50-150 | | 112 | 50-150 |
| 13C9_PFNA | | 54 | 50-150 | | 148 | 50-150 | N | 39 | 50-150 |
| d5-EtFOSAA | | 89 | 50-150 | | 148 | 50-150 | | 98 | 50-150 |
| d-MeFOSA | | 83 | 50-150 | | 150 | 50-150 | | 76 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 | | 124 | 50-150 | | 98 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-008
Description: VRTB-L-06_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 0900 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/29/2022 2159 | ASD | 04/22/2022 1218 | 39067 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 05/03/2022 0054 | NK1 | 04/22/2022 1218 | 39067 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/09/2022 1113 | MMM | 05/04/2022 1353 | 40323 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 26 | | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 110 | | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 12 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 69 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 29 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1300 | E | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 54 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 160 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 190 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 71 | Q | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 210 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 160 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 15000 | EQ | 3.5 | 1.8 | 0.87 | ng/L | 3 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 115 | 50-150 | | 143 | 50-150 | | 126 | 50-150 |
| 13C2_6:2FTS | | 103 | 50-150 | N | 159 | 50-150 | | 111 | 50-150 |
| 13C2_8:2FTS | | 97 | 50-150 | N | 151 | 50-150 | | 103 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 | N | 154 | 50-150 | | 96 | 50-150 |
| 13C2_PFTeDA | | 72 | 50-150 | N | 158 | 50-150 | | 76 | 50-150 |
| 13C3_PFBS | | 102 | 50-150 | | 144 | 50-150 | | 98 | 50-150 |
| 13C3_PFHxS | | 80 | 50-150 | | 146 | 50-150 | | 79 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 | N | 153 | 50-150 | | 91 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 | N | 154 | 50-150 | | 89 | 50-150 |
| 13C5_PFHxA | | 89 | 50-150 | | 146 | 50-150 | | 90 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 | | 149 | 50-150 | | 98 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 | | 149 | 50-150 | | 101 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 | | 145 | 50-150 | | 95 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 | | 149 | 50-150 | | 95 | 50-150 |
| 13C8_PFOS | N | 47 | 50-150 | | 146 | 50-150 | N | 37 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-008
Description: VRTB-L-06_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 0900
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 98 | 50-150 | N | 151 | 50-150 | | 112 | 50-150 |
| 13C9_PFNA | | 54 | 50-150 | | 148 | 50-150 | N | 39 | 50-150 |
| d5-EtFOSAA | | 89 | 50-150 | | 148 | 50-150 | | 98 | 50-150 |
| d-MeFOSA | | 83 | 50-150 | | 150 | 50-150 | | 76 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 | | 124 | 50-150 | | 98 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-009
Description: VRTB-L-P7_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1020 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 1937 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 05/06/2022 0201 | ASD | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 32 | J | 80 | 40 | 20 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 80 | | 80 | 40 | 20 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 80 | U | 160 | 80 | 40 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 40 | U | 80 | 40 | 20 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 59 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 17 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 830 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 33 | J | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 86 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 93 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 46 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 150 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 81 | | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 20 | U | 40 | 20 | 10 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 13000 | E | 40 | 20 | 10 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 | | 89 | 50-150 |
| 13C2_6:2FTS | | 112 | 50-150 | | 103 | 50-150 |
| 13C2_8:2FTS | | 97 | 50-150 | | 87 | 50-150 |
| 13C2_PFDoA | | 85 | 50-150 | | 84 | 50-150 |
| 13C2_PFTeDA | | 81 | 50-150 | | 79 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 | | 90 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 | | 90 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 | | 99 | 50-150 |
| 13C4_PFHpA | | 91 | 50-150 | | 98 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 | | 91 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 | | 90 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 | | 88 | 50-150 |
| 13C7_PFUdA | | 94 | 50-150 | | 84 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 | | 91 | 50-150 |
| 13C8_PFOS | | 89 | 50-150 | | 91 | 50-150 |
| 13C8_PFOSA | | 96 | 50-150 | | 86 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-009
Description: VRTB-L-P7_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1020
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | | 92 | 50-150 |
| d5-EtFOSAA | | 92 | 50-150 | | 88 | 50-150 |
| d-MeFOSA | | 77 | 50-150 | | 89 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 | | 83 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-009
Description: VRTB-L-P7_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1020 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 1937 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 05/06/2022 0201 | ASD | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 400 | U | 800 | 400 | 200 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 400 | U | 800 | 400 | 200 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 400 | U | 800 | 400 | 200 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 400 | U | 800 | 400 | 200 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 800 | U | 1600 | 800 | 400 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 400 | U | 800 | 400 | 200 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 830 | | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 140 | J | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 200 | U | 400 | 200 | 100 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 13000 | | 400 | 200 | 100 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 | | 89 | 50-150 |
| 13C2_6:2FTS | | 112 | 50-150 | | 103 | 50-150 |
| 13C2_8:2FTS | | 97 | 50-150 | | 87 | 50-150 |
| 13C2_PFDoA | | 85 | 50-150 | | 84 | 50-150 |
| 13C2_PFTeDA | | 81 | 50-150 | | 79 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 | | 90 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 | | 90 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 | | 99 | 50-150 |
| 13C4_PFHpA | | 91 | 50-150 | | 98 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 | | 91 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 | | 90 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 | | 88 | 50-150 |
| 13C7_PFUdA | | 94 | 50-150 | | 84 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 | | 91 | 50-150 |
| 13C8_PFOS | | 89 | 50-150 | | 91 | 50-150 |
| 13C8_PFOSA | | 96 | 50-150 | | 86 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-009
Description: VRTB-L-P7_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1020
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | | 92 | 50-150 |
| d5-EtFOSAA | | 92 | 50-150 | | 88 | 50-150 |
| d-MeFOSA | | 77 | 50-150 | | 89 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 | | 83 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-010
Description: VRTB-L-BB8_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1120 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 1947 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 50 | 05/18/2022 1416 | MMM | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 20 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 36 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 11 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 46 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 21 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 760 | E | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 32 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 65 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 83 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 41 | Q | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 110 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 74 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 11000 | EQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 74 | 50-150 | | 97 | 50-150 |
| 13C2_6:2FTS | | 68 | 50-150 | | 92 | 50-150 |
| 13C2_8:2FTS | | 62 | 50-150 | | 95 | 50-150 |
| 13C2_PFDoA | | 59 | 50-150 | | 95 | 50-150 |
| 13C2_PFTeDA | | 51 | 50-150 | | 94 | 50-150 |
| 13C3_PFBS | | 67 | 50-150 | | 94 | 50-150 |
| 13C3_PFHxS | | 61 | 50-150 | | 103 | 50-150 |
| 13C4_PFBA | | 66 | 50-150 | | 98 | 50-150 |
| 13C4_PFHpA | | 63 | 50-150 | | 98 | 50-150 |
| 13C5_PFHxA | | 64 | 50-150 | | 101 | 50-150 |
| 13C5_PFPeA | | 66 | 50-150 | | 94 | 50-150 |
| 13C6_PFDA | | 62 | 50-150 | | 87 | 50-150 |
| 13C7_PFUdA | | 62 | 50-150 | | 90 | 50-150 |
| 13C8_PFOA | | 65 | 50-150 | | 92 | 50-150 |
| 13C8_PFOS | N | 44 | 50-150 | | 98 | 50-150 |
| 13C8_PFOSA | | 65 | 50-150 | | 95 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-010
Description: VRTB-L-BB8_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1120
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | N | 46 | 50-150 | | 93 | 50-150 |
| d5-EtFOSAA | | 60 | 50-150 | | 94 | 50-150 |
| d-MeFOSA | | 51 | 50-150 | | 96 | 50-150 |
| d3-MeFOSAA | | 60 | 50-150 | | 88 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-010
Description: VRTB-L-BB8_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1120 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 1947 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 50 | 05/18/2022 1416 | MMM | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 180 | U | 350 | 180 | 87 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 180 | U | 350 | 180 | 87 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 180 | U | 350 | 180 | 87 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 180 | U | 350 | 180 | 87 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 350 | U | 690 | 350 | 170 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 180 | U | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 480 | | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 49 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 61 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 72 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 55 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 6400 | | 170 | 85 | 43 | ng/L | 2 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 74 | 50-150 | | 97 | 50-150 |
| 13C2_6:2FTS | | 68 | 50-150 | | 92 | 50-150 |
| 13C2_8:2FTS | | 62 | 50-150 | | 95 | 50-150 |
| 13C2_PFDoA | | 59 | 50-150 | | 95 | 50-150 |
| 13C2_PFTeDA | | 51 | 50-150 | | 94 | 50-150 |
| 13C3_PFBS | | 67 | 50-150 | | 94 | 50-150 |
| 13C3_PFHxS | | 61 | 50-150 | | 103 | 50-150 |
| 13C4_PFBA | | 66 | 50-150 | | 98 | 50-150 |
| 13C4_PFHpA | | 63 | 50-150 | | 98 | 50-150 |
| 13C5_PFHxA | | 64 | 50-150 | | 101 | 50-150 |
| 13C5_PFPeA | | 66 | 50-150 | | 94 | 50-150 |
| 13C6_PFDA | | 62 | 50-150 | | 87 | 50-150 |
| 13C7_PFUdA | | 62 | 50-150 | | 90 | 50-150 |
| 13C8_PFOA | | 65 | 50-150 | | 92 | 50-150 |
| 13C8_PFOS | N | 44 | 50-150 | | 98 | 50-150 |
| 13C8_PFOSA | | 65 | 50-150 | | 95 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-010
Description: VRTB-L-BB8_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1120
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | N | 46 | 50-150 | | 93 | 50-150 |
| d5-EtFOSAA | | 60 | 50-150 | | 94 | 50-150 |
| d-MeFOSA | | 51 | 50-150 | | 96 | 50-150 |
| d3-MeFOSAA | | 60 | 50-150 | | 88 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-011
Description: VRTB-L-B1_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1325 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2009 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 05/18/2022 1427 | MMM | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 5.2 | J | 9.3 | 4.7 | 2.3 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.9 | J | 9.3 | 4.7 | 2.3 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.7 | U | 9.3 | 4.7 | 2.3 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.7 | U | 9.3 | 4.7 | 2.3 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 9.5 | U | 19 | 9.5 | 4.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.7 | U | 9.3 | 4.7 | 2.3 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 11 | | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.4 | U | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 18 | | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.4 | U | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.4 | U | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 23 | | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 320 | | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 14 | | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.4 | U | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.4 | U | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 20 | | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 34 | | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 13 | | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 54 | | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 24 | | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.4 | UQ | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.4 | U | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.4 | U | 4.7 | 2.4 | 1.2 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1500 | E | 4.7 | 2.4 | 1.2 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 | | 92 | 50-150 |
| 13C2_6:2FTS | | 85 | 50-150 | | 78 | 50-150 |
| 13C2_8:2FTS | | 75 | 50-150 | | 84 | 50-150 |
| 13C2_PFDoA | | 65 | 50-150 | | 68 | 50-150 |
| 13C2_PFTeDA | N | 47 | 50-150 | | 51 | 50-150 |
| 13C3_PFBS | | 71 | 50-150 | | 74 | 50-150 |
| 13C3_PFHxS | | 72 | 50-150 | | 78 | 50-150 |
| 13C4_PFBA | | 68 | 50-150 | | 77 | 50-150 |
| 13C4_PFHpA | | 71 | 50-150 | | 73 | 50-150 |
| 13C5_PFHxA | | 68 | 50-150 | | 82 | 50-150 |
| 13C5_PFPeA | | 72 | 50-150 | | 74 | 50-150 |
| 13C6_PFDA | | 69 | 50-150 | | 72 | 50-150 |
| 13C7_PFUdA | | 70 | 50-150 | | 70 | 50-150 |
| 13C8_PFOA | | 71 | 50-150 | | 81 | 50-150 |
| 13C8_PFOS | | 71 | 50-150 | | 79 | 50-150 |
| 13C8_PFOSA | | 71 | 50-150 | | 75 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-011
Description: VRTB-L-B1_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1325
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 65 | 50-150 | | 75 | 50-150 |
| d5-EtFOSAA | | 71 | 50-150 | | 71 | 50-150 |
| d-MeFOSA | | 65 | 50-150 | | 77 | 50-150 |
| d3-MeFOSAA | | 68 | 50-150 | | 74 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-011
Description: VRTB-L-B1_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1325 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2009 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 05/18/2022 1427 | MMM | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 24 | U | 47 | 24 | 12 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 24 | U | 47 | 24 | 12 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 24 | U | 47 | 24 | 12 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 24 | U | 47 | 24 | 12 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 47 | U | 93 | 47 | 23 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 24 | U | 47 | 24 | 12 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 12 | J | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 12 | U | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 20 | J | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 12 | U | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 12 | U | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 24 | | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 320 | | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 14 | J | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 12 | U | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 12 | U | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 23 | | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 33 | | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 12 | J | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 50 | | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 24 | | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 12 | U | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 12 | U | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 12 | U | 23 | 12 | 5.8 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1400 | | 23 | 12 | 5.8 | ng/L | 2 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 | | 92 | 50-150 |
| 13C2_6:2FTS | | 85 | 50-150 | | 78 | 50-150 |
| 13C2_8:2FTS | | 75 | 50-150 | | 84 | 50-150 |
| 13C2_PFDoA | | 65 | 50-150 | | 68 | 50-150 |
| 13C2_PFTeDA | N | 47 | 50-150 | | 51 | 50-150 |
| 13C3_PFBS | | 71 | 50-150 | | 74 | 50-150 |
| 13C3_PFHxS | | 72 | 50-150 | | 78 | 50-150 |
| 13C4_PFBA | | 68 | 50-150 | | 77 | 50-150 |
| 13C4_PFHpA | | 71 | 50-150 | | 73 | 50-150 |
| 13C5_PFHxA | | 68 | 50-150 | | 82 | 50-150 |
| 13C5_PFPeA | | 72 | 50-150 | | 74 | 50-150 |
| 13C6_PFDA | | 69 | 50-150 | | 72 | 50-150 |
| 13C7_PFUdA | | 70 | 50-150 | | 70 | 50-150 |
| 13C8_PFOA | | 71 | 50-150 | | 81 | 50-150 |
| 13C8_PFOS | | 71 | 50-150 | | 79 | 50-150 |
| 13C8_PFOSA | | 71 | 50-150 | | 75 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-011
Description: VRTB-L-B1_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1325
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 65 | 50-150 | | 75 | 50-150 |
| d5-EtFOSAA | | 71 | 50-150 | | 71 | 50-150 |
| d-MeFOSA | | 65 | 50-150 | | 77 | 50-150 |
| d3-MeFOSAA | | 68 | 50-150 | | 74 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-012
Description: VRTB-L-S2_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1445 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2020 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 05/06/2022 0307 | ASD | 04/22/2022 1225 | 39040 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/08/2022 1804 | MMM | 05/05/2022 1625 | 40570 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 5.4 | J | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 2.0 | J | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 10 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 11 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 16 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 210 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 10 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 10 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 24 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 3.1 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 33 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 14 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 690 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 114 | 50-150 | | 86 | 50-150 | | 130 | 50-150 |
| 13C2_6:2FTS | | 95 | 50-150 | | 86 | 50-150 | N | 155 | 50-150 |
| 13C2_8:2FTS | | 82 | 50-150 | | 75 | 50-150 | | 109 | 50-150 |
| 13C2_PFDoA | | 70 | 50-150 | | 73 | 50-150 | | 96 | 50-150 |
| 13C2_PFTeDA | N | 44 | 50-150 | N | 48 | 50-150 | | 56 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 | | 84 | 50-150 | | 107 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 | | 86 | 50-150 | | 110 | 50-150 |
| 13C4_PFBA | | 86 | 50-150 | | 87 | 50-150 | | 98 | 50-150 |
| 13C4_PFHpA | | 84 | 50-150 | | 88 | 50-150 | | 101 | 50-150 |
| 13C5_PFHxA | | 81 | 50-150 | | 81 | 50-150 | | 104 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | | 82 | 50-150 | | 102 | 50-150 |
| 13C6_PFDA | | 79 | 50-150 | | 79 | 50-150 | | 102 | 50-150 |
| 13C7_PFUdA | | 78 | 50-150 | | 75 | 50-150 | | 94 | 50-150 |
| 13C8_PFOA | | 89 | 50-150 | | 88 | 50-150 | | 105 | 50-150 |
| 13C8_PFOS | | 86 | 50-150 | | 82 | 50-150 | | 82 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-012
Description: VRTB-L-S2_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1445
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 81 | 50-150 | | 82 | 50-150 | | 104 | 50-150 |
| 13C9_PFNA | | 83 | 50-150 | | 82 | 50-150 | | 85 | 50-150 |
| d5-EtFOSAA | | 78 | 50-150 | | 77 | 50-150 | | 101 | 50-150 |
| d-MeFOSA | | 68 | 50-150 | | 59 | 50-150 | | 77 | 50-150 |
| d3-MeFOSAA | | 77 | 50-150 | | 75 | 50-150 | | 114 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-012
Description: VRTB-L-S2_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1445 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2020 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 05/06/2022 0307 | ASD | 04/22/2022 1225 | 39040 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/08/2022 1804 | MMM | 05/05/2022 1625 | 40570 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 12 | J | 34 | 17 | 8.6 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.8 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 11 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 15 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 200 | | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 10 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 9.4 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 22 | | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 30 | | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 14 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 8.5 | UQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 670 | | 17 | 8.5 | 4.3 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 114 | 50-150 | | 86 | 50-150 | | 130 | 50-150 |
| 13C2_6:2FTS | | 95 | 50-150 | | 86 | 50-150 | N | 155 | 50-150 |
| 13C2_8:2FTS | | 82 | 50-150 | | 75 | 50-150 | | 109 | 50-150 |
| 13C2_PFDoA | | 70 | 50-150 | | 73 | 50-150 | | 96 | 50-150 |
| 13C2_PFTeDA | N | 44 | 50-150 | N | 48 | 50-150 | | 56 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 | | 84 | 50-150 | | 107 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 | | 86 | 50-150 | | 110 | 50-150 |
| 13C4_PFBA | | 86 | 50-150 | | 87 | 50-150 | | 98 | 50-150 |
| 13C4_PFHpA | | 84 | 50-150 | | 88 | 50-150 | | 101 | 50-150 |
| 13C5_PFHxA | | 81 | 50-150 | | 81 | 50-150 | | 104 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | | 82 | 50-150 | | 102 | 50-150 |
| 13C6_PFDA | | 79 | 50-150 | | 79 | 50-150 | | 102 | 50-150 |
| 13C7_PFUdA | | 78 | 50-150 | | 75 | 50-150 | | 94 | 50-150 |
| 13C8_PFOA | | 89 | 50-150 | | 88 | 50-150 | | 105 | 50-150 |
| 13C8_PFOS | | 86 | 50-150 | | 82 | 50-150 | | 82 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-012
Description: VRTB-L-S2_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1445
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 81 | 50-150 | | 82 | 50-150 | | 104 | 50-150 |
| 13C9_PFNA | | 83 | 50-150 | | 82 | 50-150 | | 85 | 50-150 |
| d5-EtFOSAA | | 78 | 50-150 | | 77 | 50-150 | | 101 | 50-150 |
| d-MeFOSA | | 68 | 50-150 | | 59 | 50-150 | | 77 | 50-150 |
| d3-MeFOSAA | | 77 | 50-150 | | 75 | 50-150 | | 114 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-012
Description: VRTB-L-S2_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1445 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2020 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 05/06/2022 0307 | ASD | 04/22/2022 1225 | 39040 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/08/2022 1804 | MMM | 05/05/2022 1625 | 40570 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 5.2 | J | 7.0 | 3.5 | 1.8 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 7.0 | 3.5 | 1.8 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 8.6 | | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 11 | | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 13 | | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 180 | | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 9.4 | | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 10 | | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 19 | | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 3.3 | J | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 27 | | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 13 | | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 630 | E | 3.5 | 1.8 | 0.88 | ng/L | 3 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits | Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 114 | 50-150 | | 86 | 50-150 | | 130 | 50-150 |
| 13C2_6:2FTS | | 95 | 50-150 | | 86 | 50-150 | N | 155 | 50-150 |
| 13C2_8:2FTS | | 82 | 50-150 | | 75 | 50-150 | | 109 | 50-150 |
| 13C2_PFDoA | | 70 | 50-150 | | 73 | 50-150 | | 96 | 50-150 |
| 13C2_PFTeDA | N | 44 | 50-150 | N | 48 | 50-150 | | 56 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 | | 84 | 50-150 | | 107 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 | | 86 | 50-150 | | 110 | 50-150 |
| 13C4_PFBA | | 86 | 50-150 | | 87 | 50-150 | | 98 | 50-150 |
| 13C4_PFHpA | | 84 | 50-150 | | 88 | 50-150 | | 101 | 50-150 |
| 13C5_PFHxA | | 81 | 50-150 | | 81 | 50-150 | | 104 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | | 82 | 50-150 | | 102 | 50-150 |
| 13C6_PFDA | | 79 | 50-150 | | 79 | 50-150 | | 102 | 50-150 |
| 13C7_PFUdA | | 78 | 50-150 | | 75 | 50-150 | | 94 | 50-150 |
| 13C8_PFOA | | 89 | 50-150 | | 88 | 50-150 | | 105 | 50-150 |
| 13C8_PFOS | | 86 | 50-150 | | 82 | 50-150 | | 82 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-012
Description: VRTB-L-S2_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1445
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 81 | 50-150 | | 82 | 50-150 | | 104 | 50-150 |
| 13C9_PFNA | | 83 | 50-150 | | 82 | 50-150 | | 85 | 50-150 |
| d5-EtFOSAA | | 78 | 50-150 | | 77 | 50-150 | | 101 | 50-150 |
| d-MeFOSA | | 68 | 50-150 | | 59 | 50-150 | | 77 | 50-150 |
| d3-MeFOSAA | | 77 | 50-150 | | 75 | 50-150 | | 114 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-013
Description: VRTB-L-Y3_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1530 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2031 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 50 | 05/04/2022 1956 | LAB | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 69 | | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 42 | | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 16 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 100 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.0 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 41 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1400 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 50 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 110 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 200 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 44 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 150 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 110 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 5300 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 116 | 50-150 | | 92 | 50-150 |
| 13C2_6:2FTS | | 102 | 50-150 | | 102 | 50-150 |
| 13C2_8:2FTS | | 84 | 50-150 | | 107 | 50-150 |
| 13C2_PFDoA | | 74 | 50-150 | | 104 | 50-150 |
| 13C2_PFTeDA | | 62 | 50-150 | | 104 | 50-150 |
| 13C3_PFBS | | 83 | 50-150 | | 96 | 50-150 |
| 13C3_PFHxS | | 72 | 50-150 | | 98 | 50-150 |
| 13C4_PFBA | | 76 | 50-150 | | 96 | 50-150 |
| 13C4_PFHpA | | 79 | 50-150 | | 94 | 50-150 |
| 13C5_PFHxA | | 81 | 50-150 | | 98 | 50-150 |
| 13C5_PFPeA | | 82 | 50-150 | | 99 | 50-150 |
| 13C6_PFDA | | 78 | 50-150 | | 97 | 50-150 |
| 13C7_PFUdA | | 79 | 50-150 | | 99 | 50-150 |
| 13C8_PFOA | | 82 | 50-150 | | 95 | 50-150 |
| 13C8_PFOS | | 67 | 50-150 | | 95 | 50-150 |
| 13C8_PFOSA | | 87 | 50-150 | | 98 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-013
Description: VRTB-L-Y3_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1530
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 67 | 50-150 | | 97 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 | | 105 | 50-150 |
| d-MeFOSA | | 70 | 50-150 | | 94 | 50-150 |
| d3-MeFOSAA | | 80 | 50-150 | | 106 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-013
Description: VRTB-L-Y3_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1530 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2031 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 50 | 05/04/2022 1956 | LAB | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 90 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1200 | | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 44 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 110 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 190 | | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 150 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 92 | J | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 4400 | | 170 | 85 | 43 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 116 | 50-150 | | 92 | 50-150 |
| 13C2_6:2FTS | | 102 | 50-150 | | 102 | 50-150 |
| 13C2_8:2FTS | | 84 | 50-150 | | 107 | 50-150 |
| 13C2_PFDoA | | 74 | 50-150 | | 104 | 50-150 |
| 13C2_PFTeDA | | 62 | 50-150 | | 104 | 50-150 |
| 13C3_PFBS | | 83 | 50-150 | | 96 | 50-150 |
| 13C3_PFHxS | | 72 | 50-150 | | 98 | 50-150 |
| 13C4_PFBA | | 76 | 50-150 | | 96 | 50-150 |
| 13C4_PFHpA | | 79 | 50-150 | | 94 | 50-150 |
| 13C5_PFHxA | | 81 | 50-150 | | 98 | 50-150 |
| 13C5_PFPeA | | 82 | 50-150 | | 99 | 50-150 |
| 13C6_PFDA | | 78 | 50-150 | | 97 | 50-150 |
| 13C7_PFUdA | | 79 | 50-150 | | 99 | 50-150 |
| 13C8_PFOA | | 82 | 50-150 | | 95 | 50-150 |
| 13C8_PFOS | | 67 | 50-150 | | 95 | 50-150 |
| 13C8_PFOSA | | 87 | 50-150 | | 98 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-013
Description: VRTB-L-Y3_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1530
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 67 | 50-150 | | 97 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 | | 105 | 50-150 |
| d-MeFOSA | | 70 | 50-150 | | 94 | 50-150 |
| d3-MeFOSAA | | 80 | 50-150 | | 106 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-014
Description: VRTB-L-G4_04142022 | Matrix: Aqueous
Date Sampled: 04/15/2022 1630 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2042 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 05/06/2022 0212 | ASD | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 18 | | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 28 | | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 23 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 17 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 34 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 680 | E | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 40 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 91 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 170 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.8 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 70 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 120 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1300 | E | 3.5 | 1.8 | 0.88 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 110 | 50-150 | | 106 | 50-150 |
| 13C2_6:2FTS | | 106 | 50-150 | | 102 | 50-150 |
| 13C2_8:2FTS | | 96 | 50-150 | | 98 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 | | 94 | 50-150 |
| 13C2_PFTeDA | | 78 | 50-150 | | 81 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 | | 102 | 50-150 |
| 13C3_PFHxS | | 86 | 50-150 | | 101 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 | | 107 | 50-150 |
| 13C4_PFHpA | | 92 | 50-150 | | 109 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 | | 100 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 | | 102 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 | | 95 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 | | 93 | 50-150 |
| 13C8_PFOA | | 101 | 50-150 | | 101 | 50-150 |
| 13C8_PFOS | | 91 | 50-150 | | 100 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 | | 100 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-014
Description: VRTB-L-G4_04142022
Matrix: Aqueous
Date Sampled: 04/15/2022 1630
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | | 101 | 50-150 |
| d5-EtFOSAA | | 91 | 50-150 | | 97 | 50-150 |
| d-MeFOSA | | 83 | 50-150 | | 82 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 | | 89 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-014
Description: VRTB-L-G4_04142022 | Matrix: Aqueous
Date Sampled: 04/15/2022 1630 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2042 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 05/06/2022 0212 | ASD | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 22 | J | 71 | 36 | 18 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 25 | J | 71 | 36 | 18 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 36 | U | 71 | 36 | 18 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 36 | U | 71 | 36 | 18 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 70 | U | 140 | 70 | 35 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 36 | U | 71 | 36 | 18 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 22 | J | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 15 | J | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 37 | | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 610 | | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 39 | | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 84 | | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 160 | | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 74 | | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 120 | | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.8 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1200 | | 35 | 18 | 8.8 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 110 | 50-150 | | 106 | 50-150 |
| 13C2_6:2FTS | | 106 | 50-150 | | 102 | 50-150 |
| 13C2_8:2FTS | | 96 | 50-150 | | 98 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 | | 94 | 50-150 |
| 13C2_PFTeDA | | 78 | 50-150 | | 81 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 | | 102 | 50-150 |
| 13C3_PFHxS | | 86 | 50-150 | | 101 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 | | 107 | 50-150 |
| 13C4_PFHpA | | 92 | 50-150 | | 109 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 | | 100 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 | | 102 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 | | 95 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 | | 93 | 50-150 |
| 13C8_PFOA | | 101 | 50-150 | | 101 | 50-150 |
| 13C8_PFOS | | 91 | 50-150 | | 100 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 | | 100 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-014
Description: VRTB-L-G4_04142022
Matrix: Aqueous
Date Sampled: 04/15/2022 1630
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | | 101 | 50-150 |
| d5-EtFOSAA | | 91 | 50-150 | | 97 | 50-150 |
| d-MeFOSA | | 83 | 50-150 | | 82 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 | | 89 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-015
Description: DUP-02_04142022 | Matrix: Aqueous
Date Sampled: 04/15/2022 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2053 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 05/06/2022 0223 | ASD | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 18 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 27 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 23 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 17 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 35 | S | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 690 | ES | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 41 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 88 | S | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 170 | S | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.5 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 74 | S | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 120 | S | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1300 | ES | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 113 | 50-150 | | 101 | 50-150 |
| 13C2_6:2FTS | | 107 | 50-150 | | 103 | 50-150 |
| 13C2_8:2FTS | | 96 | 50-150 | | 88 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 | | 75 | 50-150 |
| 13C2_PFTeDA | | 71 | 50-150 | | 72 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 | | 100 | 50-150 |
| 13C3_PFHxS | | 86 | 50-150 | | 97 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 | | 99 | 50-150 |
| 13C4_PFHpA | | 94 | 50-150 | | 97 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 | | 91 | 50-150 |
| 13C5_PFPeA | | 95 | 50-150 | | 94 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 | | 88 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 | | 81 | 50-150 |
| 13C8_PFOA | | 104 | 50-150 | | 100 | 50-150 |
| 13C8_PFOS | | 87 | 50-150 | | 93 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 | | 87 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-015
Description: DUP-02_04142022
Matrix: Aqueous
Date Sampled: 04/15/2022
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | | 97 | 50-150 |
| d5-EtFOSAA | | 86 | 50-150 | | 86 | 50-150 |
| d-MeFOSA | | 78 | 50-150 | | 69 | 50-150 |
| d3-MeFOSAA | | 86 | 50-150 | | 81 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16001-015
Description: DUP-02_04142022 | Matrix: Aqueous
Date Sampled: 04/15/2022 | Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2053 | LAB | 04/22/2022 1225 | 39040 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 05/06/2022 0223 | ASD | 04/22/2022 1225 | 39040 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 18 | J | 69 | 35 | 17 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 23 | J | 69 | 35 | 17 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 70 | U | 140 | 70 | 35 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 23 | J | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 13 | J | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 35 | | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 600 | S | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 40 | | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 92 | S | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 180 | S | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 74 | S | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 120 | S | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 18 | U | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1200 | S | 35 | 18 | 8.7 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 113 | 50-150 | | 101 | 50-150 |
| 13C2_6:2FTS | | 107 | 50-150 | | 103 | 50-150 |
| 13C2_8:2FTS | | 96 | 50-150 | | 88 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 | | 75 | 50-150 |
| 13C2_PFTeDA | | 71 | 50-150 | | 72 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 | | 100 | 50-150 |
| 13C3_PFHxS | | 86 | 50-150 | | 97 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 | | 99 | 50-150 |
| 13C4_PFHpA | | 94 | 50-150 | | 97 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 | | 91 | 50-150 |
| 13C5_PFPeA | | 95 | 50-150 | | 94 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 | | 88 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 | | 81 | 50-150 |
| 13C8_PFOA | | 104 | 50-150 | | 100 | 50-150 |
| 13C8_PFOS | | 87 | 50-150 | | 93 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 | | 87 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16001-015
Description: DUP-02_04142022
Matrix: Aqueous
Date Sampled: 04/15/2022
Project Name: ESTCP Vertebrae - Grayling
Date Received: 04/16/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | | 97 | 50-150 |
| d5-EtFOSAA | | 86 | 50-150 | | 86 | 50-150 |
| d-MeFOSA | | 78 | 50-150 | | 69 | 50-150 |
| d3-MeFOSAA | | 86 | 50-150 | | 81 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: XQ39040-001
Batch: 39040
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1225

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/02/2022 1842 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/02/2022 1842 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/02/2022 1842 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/02/2022 1842 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 05/02/2022 1842 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/02/2022 1842 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/02/2022 1842 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 99 | 50-150 |
| 13C2_6:2FTS | | 105 | 50-150 |
| 13C2_8:2FTS | | 89 | 50-150 |
| 13C2_PFDoA | | 90 | 50-150 |
| 13C2_PFTeDA | | 82 | 50-150 |
| 13C3_PFBS | | 96 | 50-150 |
| 13C3_PFHxS | | 98 | 50-150 |
| 13C4_PFBA | | 96 | 50-150 |
| 13C4_PFHpA | | 96 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 88 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 |
| 13C8_PFOA | | 100 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ39040-001
Batch: 39040
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1225

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 97 | 50-150 |
| 13C8_PFOSA | | 98 | 50-150 |
| 13C9_PFNA | | 93 | 50-150 |
| d5-EtFOSAA | | 90 | 50-150 |
| d-MeFOSA | | 86 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ39040-002
Batch: 39040
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1225

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 15 | | 1 | 101 | 67-138 | 05/02/2022 1915 |
| 6:2 FTS | 15 | 18 | | 1 | 116 | 64-140 | 05/02/2022 1915 |
| 4:2 FTS | 15 | 16 | | 1 | 107 | 63-143 | 05/02/2022 1915 |
| EtFOSAA | 16 | 16 | | 1 | 103 | 61-135 | 05/02/2022 1915 |
| MeFOSA | 16 | 17 | | 1 | 104 | 68-141 | 05/02/2022 1915 |
| MeFOSAA | 16 | 17 | | 1 | 105 | 65-136 | 05/02/2022 1915 |
| PFBS | 14 | 15 | | 1 | 103 | 72-130 | 05/02/2022 1915 |
| PFDS | 15 | 13 | | 1 | 86 | 53-142 | 05/02/2022 1915 |
| PFHpS | 15 | 17 | | 1 | 114 | 69-134 | 05/02/2022 1915 |
| PFNS | 15 | 14 | | 1 | 94 | 69-127 | 05/02/2022 1915 |
| PFOSA | 16 | 17 | | 1 | 107 | 67-137 | 05/02/2022 1915 |
| PFPeS | 15 | 16 | | 1 | 104 | 71-127 | 05/02/2022 1915 |
| PFHxS | 15 | 15 | | 1 | 105 | 68-131 | 05/02/2022 1915 |
| PFBA | 16 | 17 | | 1 | 108 | 73-129 | 05/02/2022 1915 |
| PFDA | 16 | 17 | | 1 | 108 | 71-129 | 05/02/2022 1915 |
| PFDoA | 16 | 17 | | 1 | 106 | 72-134 | 05/02/2022 1915 |
| PFHpA | 16 | 16 | | 1 | 100 | 72-130 | 05/02/2022 1915 |
| PFHxA | 16 | 17 | | 1 | 104 | 72-129 | 05/02/2022 1915 |
| PFNA | 16 | 18 | | 1 | 110 | 69-130 | 05/02/2022 1915 |
| PFOA | 16 | 17 | | 1 | 105 | 71-133 | 05/02/2022 1915 |
| PFPeA | 16 | 17 | | 1 | 106 | 72-129 | 05/02/2022 1915 |
| PFTeDA | 16 | 18 | | 1 | 111 | 71-132 | 05/02/2022 1915 |
| PFTrDA | 16 | 16 | | 1 | 98 | 65-144 | 05/02/2022 1915 |
| PFUdA | 16 | 16 | | 1 | 102 | 69-133 | 05/02/2022 1915 |
| PFOS | 15 | 15 | | 1 | 99 | 65-140 | 05/02/2022 1915 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 98 | 50-150 |
| 13C2_6:2FTS | | 100 | 50-150 |
| 13C2_8:2FTS | | 88 | 50-150 |
| 13C2_PFDoA | | 80 | 50-150 |
| 13C2_PFTeDA | | 55 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 |
| 13C4_PFBA | | 94 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 |
| 13C5_PFHxA | | 90 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 |
| 13C6_PFDA | | 89 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 |
| 13C8_PFOA | | 97 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ39040-002
Batch: 39040
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1225

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 99 | 50-150 |
| 13C8_PFOSA | | 94 | 50-150 |
| 13C9_PFNA | | 92 | 50-150 |
| d5-EtFOSAA | | 81 | 50-150 |
| d-MeFOSA | | 82 | 50-150 |
| d3-MeFOSAA | | 83 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: XD16001-010DU
Batch: 39040
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1225

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 20 | 19 | | 1 | 2.3 | 20 | 05/02/2022 1958 |
| 6:2 FTS | 36 | 37 | | 1 | 2.8 | 20 | 05/02/2022 1958 |
| 4:2 FTS | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| EtFOSAA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| MeFOSA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| MeFOSAA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| PFBS | 11 | 11 | | 1 | 0.26 | 20 | 05/02/2022 1958 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| PFHpS | 46 | 43 | | 1 | 7.9 | 20 | 05/02/2022 1958 |
| PFNS | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| PFOSA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| PFPeS | 21 | 21 | | 1 | 4.1 | 20 | 05/02/2022 1958 |
| PFHxS | 760 | 750 | E | 1 | 0.93 | 20 | 05/02/2022 1958 |
| PFBA | 32 | 30 | | 1 | 4.8 | 20 | 05/02/2022 1958 |
| PFDA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| PFHpA | 65 | 68 | | 1 | 4.5 | 20 | 05/02/2022 1958 |
| PFHxA | 83 | 85 | | 1 | 2.7 | 20 | 05/02/2022 1958 |
| PFNA | 41 | 45 | | 1 | 7.4 | 20 | 05/02/2022 1958 |
| PFOA | 110 | 96 | | 1 | 10 | 20 | 05/02/2022 1958 |
| PFPeA | 74 | 72 | | 1 | 3.3 | 20 | 05/02/2022 1958 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| PFUdA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 1958 |
| PFOS | 11000 | 10000 | E | 1 | 6.7 | 20 | 05/02/2022 1958 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 115 | 50-150 |
| 13C2_6:2FTS | | 96 | 50-150 |
| 13C2_8:2FTS | | 90 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 68 | 50-150 |
| 13C3_PFBS | | 92 | 50-150 |
| 13C3_PFHxS | | 83 | 50-150 |
| 13C4_PFBA | | 91 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 |
| 13C6_PFDA | | 83 | 50-150 |
| 13C7_PFUdA | | 82 | 50-150 |
| 13C8_PFOA | | 94 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: XD16001-010DU
Batch: 39040
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1225

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 60 | 50-150 |
| 13C8_PFOSA | | 88 | 50-150 |
| 13C9_PFNA | | 57 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 |
| d-MeFOSA | | 68 | 50-150 |
| d3-MeFOSAA | | 80 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XD16001-015MS
Batch: 39040
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1225

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 18 | 15 | 34 | | 10 | 103 | 67-138 | 05/06/2022 0234 |
| 6:2 FTS | 23 | 15 | 36 | | 10 | 85 | 64-140 | 05/06/2022 0234 |
| 4:2 FTS | ND | 15 | 15 | | 10 | 100 | 63-143 | 05/06/2022 0234 |
| EtFOSAA | ND | 16 | 14 | | 10 | 89 | 61-135 | 05/06/2022 0234 |
| MeFOSA | ND | 16 | 14 | | 10 | 85 | 68-141 | 05/06/2022 0234 |
| MeFOSAA | ND | 16 | 14 | | 10 | 87 | 65-136 | 05/06/2022 0234 |
| PFBS | 23 | 14 | 37 | | 10 | 100 | 72-130 | 05/06/2022 0234 |
| PFDS | ND | 15 | 12 | | 10 | 77 | 53-142 | 05/06/2022 0234 |
| PFHpS | 13 | 15 | 30 | | 10 | 112 | 69-134 | 05/06/2022 0234 |
| PFNS | ND | 15 | 14 | | 10 | 88 | 69-127 | 05/06/2022 0234 |
| PFOSA | ND | 16 | 16 | | 10 | 97 | 67-137 | 05/06/2022 0234 |
| PFPeS | 35 | 15 | 48 | | 10 | 86 | 71-127 | 05/06/2022 0234 |
| PFHxS | 600 | 15 | 660 | N | 10 | 439 | 68-131 | 05/06/2022 0234 |
| PFBA | 40 | 16 | 55 | | 10 | 88 | 73-129 | 05/06/2022 0234 |
| PFDA | ND | 16 | 15 | | 10 | 92 | 71-129 | 05/06/2022 0234 |
| PFDoA | ND | 16 | 13 | | 10 | 84 | 72-134 | 05/06/2022 0234 |
| PFHpA | 92 | 16 | 97 | N | 10 | 35 | 72-130 | 05/06/2022 0234 |
| PFHxA | 180 | 16 | 180 | N | 10 | 36 | 72-129 | 05/06/2022 0234 |
| PFNA | ND | 16 | 22 | | 10 | 93 | 69-130 | 05/06/2022 0234 |
| PFOA | 74 | 16 | 97 | N | 10 | 145 | 71-133 | 05/06/2022 0234 |
| PFPeA | 120 | 16 | 130 | N | 10 | 59 | 72-129 | 05/06/2022 0234 |
| PFTeDA | ND | 16 | 15 | | 10 | 93 | 71-132 | 05/06/2022 0234 |
| PFTrDA | ND | 16 | 13 | | 10 | 82 | 65-144 | 05/06/2022 0234 |
| PFUdA | ND | 16 | 14 | | 10 | 89 | 69-133 | 05/06/2022 0234 |
| PFOS | 1200 | 15 | 1300 | N | 10 | 468 | 65-140 | 05/06/2022 0234 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 |
| 13C2_6:2FTS | | 123 | 50-150 |
| 13C2_8:2FTS | | 104 | 50-150 |
| 13C2_PFDoA | | 104 | 50-150 |
| 13C2_PFTeDA | | 86 | 50-150 |
| 13C3_PFBS | | 112 | 50-150 |
| 13C3_PFHxS | | 106 | 50-150 |
| 13C4_PFBA | | 114 | 50-150 |
| 13C4_PFHpA | | 113 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 |
| 13C5_PFPeA | | 110 | 50-150 |
| 13C6_PFDA | | 102 | 50-150 |
| 13C7_PFUdA | | 102 | 50-150 |
| 13C8_PFOA | | 109 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XD16001-015MS
Batch: 39040
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1225

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 101 | 50-150 |
| 13C8_PFOSA | | 99 | 50-150 |
| 13C9_PFNA | | 102 | 50-150 |
| d5-EtFOSAA | | 104 | 50-150 |
| d-MeFOSA | | 90 | 50-150 |
| d3-MeFOSAA | | 101 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ39067-001
Batch: 39067
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1218

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/29/2022 1959 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/29/2022 1959 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/29/2022 1959 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/29/2022 1959 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 04/29/2022 1959 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/29/2022 1959 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/29/2022 1959 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 95 | 50-150 |
| 13C2_6:2FTS | | 109 | 50-150 |
| 13C2_8:2FTS | | 89 | 50-150 |
| 13C2_PFDoA | | 84 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 |
| 13C3_PFBS | | 90 | 50-150 |
| 13C3_PFHxS | | 90 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 |
| 13C5_PFHxA | | 86 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 |
| 13C6_PFDA | | 80 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ39067-001
Batch: 39067
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1218

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 86 | 50-150 |
| 13C8_PFOSA | | 90 | 50-150 |
| 13C9_PFNA | | 89 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 |
| d-MeFOSA | | 50 | 50-150 |
| d3-MeFOSAA | | 86 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ39067-002
Batch: 39067
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1218

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 17 | | 1 | 108 | 67-138 | 04/29/2022 2010 |
| 6:2 FTS | 15 | 28 | N | 1 | 184 | 64-140 | 04/29/2022 2010 |
| 4:2 FTS | 15 | 15 | | 1 | 103 | 63-143 | 04/29/2022 2010 |
| EtFOSAA | 16 | 17 | | 1 | 104 | 61-135 | 04/29/2022 2010 |
| MeFOSA | 16 | 17 | | 1 | 103 | 68-141 | 04/29/2022 2010 |
| MeFOSAA | 16 | 17 | | 1 | 108 | 65-136 | 04/29/2022 2010 |
| PFBS | 14 | 15 | | 1 | 103 | 72-130 | 04/29/2022 2010 |
| PFDS | 15 | 16 | | 1 | 101 | 53-142 | 04/29/2022 2010 |
| PFHpS | 15 | 17 | | 1 | 109 | 69-134 | 04/29/2022 2010 |
| PFNS | 15 | 15 | | 1 | 98 | 69-127 | 04/29/2022 2010 |
| PFOSA | 16 | 16 | | 1 | 98 | 67-137 | 04/29/2022 2010 |
| PFPeS | 15 | 15 | | 1 | 99 | 71-127 | 04/29/2022 2010 |
| PFHxS | 15 | 15 | | 1 | 103 | 68-131 | 04/29/2022 2010 |
| PFBA | 16 | 17 | | 1 | 104 | 73-129 | 04/29/2022 2010 |
| PFDA | 16 | 17 | | 1 | 105 | 71-129 | 04/29/2022 2010 |
| PFDoA | 16 | 16 | | 1 | 99 | 72-134 | 04/29/2022 2010 |
| PFHpA | 16 | 16 | | 1 | 102 | 72-130 | 04/29/2022 2010 |
| PFHxA | 16 | 16 | | 1 | 98 | 72-129 | 04/29/2022 2010 |
| PFNA | 16 | 16 | | 1 | 100 | 69-130 | 04/29/2022 2010 |
| PFOA | 16 | 17 | | 1 | 106 | 71-133 | 04/29/2022 2010 |
| PFPeA | 16 | 17 | | 1 | 108 | 72-129 | 04/29/2022 2010 |
| PFTeDA | 16 | 17 | | 1 | 106 | 71-132 | 04/29/2022 2010 |
| PFTrDA | 16 | 16 | | 1 | 98 | 65-144 | 04/29/2022 2010 |
| PFUdA | 16 | 16 | | 1 | 103 | 69-133 | 04/29/2022 2010 |
| PFOS | 15 | 15 | | 1 | 103 | 65-140 | 04/29/2022 2010 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 |
| 13C2_6:2FTS | | 108 | 50-150 |
| 13C2_8:2FTS | | 93 | 50-150 |
| 13C2_PFDoA | | 92 | 50-150 |
| 13C2_PFTeDA | | 87 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 94 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 |
| 13C6_PFDA | | 84 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 |
| 13C8_PFOA | | 96 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ39067-002
Batch: 39067
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1218

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 89 | 50-150 |
| 13C8_PFOSA | | 95 | 50-150 |
| 13C9_PFNA | | 93 | 50-150 |
| d5-EtFOSAA | | 85 | 50-150 |
| d-MeFOSA | | 57 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XD16001-002MS
Batch: 39067
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1218

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 18 | 13 | 34 | | 1 | 120 | 67-138 | 04/29/2022 2043 |
| 6:2 FTS | 49 | 13 | 63 | | 1 | 104 | 64-140 | 04/29/2022 2043 |
| 4:2 FTS | ND | 13 | 14 | | 1 | 106 | 63-143 | 04/29/2022 2043 |
| EtFOSAA | ND | 14 | 15 | | 1 | 105 | 61-135 | 04/29/2022 2043 |
| MeFOSA | ND | 14 | 13 | | 1 | 93 | 68-141 | 04/29/2022 2043 |
| MeFOSAA | ND | 14 | 15 | | 1 | 108 | 65-136 | 04/29/2022 2043 |
| PFBS | 12 | 12 | 24 | | 1 | 96 | 72-130 | 04/29/2022 2043 |
| PFDS | ND | 13 | 21 | N | 1 | 155 | 53-142 | 04/29/2022 2043 |
| PFHpS | 69 | 13 | 79 | | 1 | 82 | 69-134 | 04/29/2022 2043 |
| PFNS | ND | 13 | 23 | N | 1 | 177 | 69-127 | 04/29/2022 2043 |
| PFOSA | ND | 14 | 15 | | 1 | 106 | 67-137 | 04/29/2022 2043 |
| PFPeS | 33 | 13 | 45 | | 1 | 86 | 71-127 | 04/29/2022 2043 |
| PFHxS | 1200 | 13 | 1200 | N | 1 | -25 | 68-131 | 04/29/2022 2043 |
| PFBA | 44 | 14 | 56 | | 1 | 87 | 73-129 | 04/29/2022 2043 |
| PFDA | ND | 14 | 15 | | 1 | 111 | 71-129 | 04/29/2022 2043 |
| PFDoA | ND | 14 | 16 | | 1 | 112 | 72-134 | 04/29/2022 2043 |
| PFHpA | 97 | 14 | 110 | N | 1 | 63 | 72-130 | 04/29/2022 2043 |
| PFHxA | 130 | 14 | 140 | | 1 | 79 | 72-129 | 04/29/2022 2043 |
| PFNA | 56 | 14 | 66 | | 1 | 78 | 69-130 | 04/29/2022 2043 |
| PFOA | 170 | 14 | 160 | N | 1 | -33 | 71-133 | 04/29/2022 2043 |
| PFPeA | 110 | 14 | 120 | N | 1 | 42 | 72-129 | 04/29/2022 2043 |
| PFTeDA | ND | 14 | 15 | | 1 | 109 | 71-132 | 04/29/2022 2043 |
| PFTrDA | ND | 14 | 15 | | 1 | 108 | 65-144 | 04/29/2022 2043 |
| PFUdA | ND | 14 | 14 | | 1 | 103 | 69-133 | 04/29/2022 2043 |
| PFOS | 11000 | 13 | 10000 | N | 1 | -3040 | 65-140 | 04/29/2022 2043 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 100 | 50-150 |
| 13C2_6:2FTS | | 91 | 50-150 |
| 13C2_8:2FTS | | 86 | 50-150 |
| 13C2_PFDoA | | 83 | 50-150 |
| 13C2_PFTeDA | | 86 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 |
| 13C3_PFHxS | | 77 | 50-150 |
| 13C4_PFBA | | 83 | 50-150 |
| 13C4_PFHpA | | 82 | 50-150 |
| 13C5_PFHxA | | 84 | 50-150 |
| 13C5_PFPeA | | 87 | 50-150 |
| 13C6_PFDA | | 81 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XD16001-002MS
Batch: 39067
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1218

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 52 | 50-150 |
| 13C8_PFOSA | | 90 | 50-150 |
| 13C9_PFNA | | 57 | 50-150 |
| d5-EtFOSAA | | 85 | 50-150 |
| d-MeFOSA | | 83 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: XD16001-005DU
Batch: 39067
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1218

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 66 | 67 | | 1 | 1.9 | 20 | 04/29/2022 2126 |
| 6:2 FTS | 270 | 250 | | 1 | 8.3 | 20 | 04/29/2022 2126 |
| 4:2 FTS | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| EtFOSAA | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| MeFOSA | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| MeFOSAA | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| PFBS | 19 | 18 | | 1 | 1.1 | 20 | 04/29/2022 2126 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| PFHpS | 100 | 110 | | 1 | 1.6 | 20 | 04/29/2022 2126 |
| PFNS | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| PFOSA | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| PFPeS | 53 | 53 | | 1 | 0.030 | 20 | 04/29/2022 2126 |
| PFHxS | 2100 | 2100 | | 1 | 0.030 | 20 | 05/03/2022 0032 |
| PFBA | 45 | 47 | | 1 | 3.0 | 20 | 04/29/2022 2126 |
| PFDA | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| PFHpA | 190 | 180 | | 1 | 5.6 | 20 | 04/29/2022 2126 |
| PFHxA | 200 | 200 | | 1 | 0.46 | 20 | 04/29/2022 2126 |
| PFNA | 100 | 97 | | 1 | 7.2 | 20 | 04/29/2022 2126 |
| PFOA | 330 | 410 | + | 1 | 23 | 20 | 05/03/2022 0032 |
| PFPeA | 130 | 140 | | 1 | 3.3 | 20 | 04/29/2022 2126 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| PFUdA | ND | ND | | 1 | 0.00 | 20 | 04/29/2022 2126 |
| PFOS | 15000 | 14000 | | 1 | 7.4 | 20 | 05/03/2022 0032 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 102 | 50-150 |
| 13C2_6:2FTS | | 91 | 50-150 |
| 13C2_8:2FTS | | 91 | 50-150 |
| 13C2_PFDoA | | 86 | 50-150 |
| 13C2_PFTeDA | | 83 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 |
| 13C4_PFBA | | 85 | 50-150 |
| 13C4_PFHpA | | 81 | 50-150 |
| 13C5_PFHxA | | 87 | 50-150 |
| 13C5_PFPeA | | 87 | 50-150 |
| 13C6_PFDA | | 82 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 91 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: XD16001-005DU
Batch: 39067
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/22/2022 1218

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 93 | 50-150 |
| 13C9_PFNA | | 53 | 50-150 |
| d5-EtFOSAA | | 87 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 89 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ40323-001
Batch: 40323
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/04/2022 1353

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/09/2022 1030 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/09/2022 1030 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/09/2022 1030 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/09/2022 1030 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 05/09/2022 1030 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/09/2022 1030 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/09/2022 1030 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 104 | 50-150 |
| 13C2_6:2FTS | | 107 | 50-150 |
| 13C2_8:2FTS | | 79 | 50-150 |
| 13C2_PFDoA | | 92 | 50-150 |
| 13C2_PFTeDA | | 90 | 50-150 |
| 13C3_PFBS | | 96 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 100 | 50-150 |
| 13C4_PFHpA | | 103 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 |
| 13C6_PFDA | | 108 | 50-150 |
| 13C7_PFUdA | | 97 | 50-150 |
| 13C8_PFOA | | 107 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ40323-001
Batch: 40323
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/04/2022 1353

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 94 | 50-150 |
| 13C8_PFOSA | | 104 | 50-150 |
| 13C9_PFNA | | 94 | 50-150 |
| d5-EtFOSAA | | 94 | 50-150 |
| d-MeFOSA | | 60 | 50-150 |
| d3-MeFOSAA | | 98 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ40323-002
Batch: 40323
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/04/2022 1353

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 15 | | 1 | 101 | 67-138 | 05/09/2022 1041 |
| 6:2 FTS | 15 | 17 | | 1 | 115 | 64-140 | 05/09/2022 1041 |
| 4:2 FTS | 15 | 15 | | 1 | 98 | 63-143 | 05/09/2022 1041 |
| EtFOSAA | 16 | 17 | | 1 | 108 | 61-135 | 05/09/2022 1041 |
| MeFOSA | 16 | 17 | | 1 | 109 | 68-141 | 05/09/2022 1041 |
| MeFOSAA | 16 | 16 | | 1 | 101 | 65-136 | 05/09/2022 1041 |
| PFBS | 14 | 14 | | 1 | 96 | 72-130 | 05/09/2022 1041 |
| PFDS | 15 | 16 | | 1 | 102 | 53-142 | 05/09/2022 1041 |
| PFHpS | 15 | 17 | | 1 | 109 | 69-134 | 05/09/2022 1041 |
| PFNS | 15 | 15 | | 1 | 97 | 69-127 | 05/09/2022 1041 |
| PFOSA | 16 | 17 | | 1 | 108 | 67-137 | 05/09/2022 1041 |
| PFPeS | 15 | 15 | | 1 | 103 | 71-127 | 05/09/2022 1041 |
| PFHxS | 15 | 17 | | 1 | 113 | 68-131 | 05/09/2022 1041 |
| PFBA | 16 | 16 | | 1 | 101 | 73-129 | 05/09/2022 1041 |
| PFDA | 16 | 16 | | 1 | 101 | 71-129 | 05/09/2022 1041 |
| PFDoA | 16 | 17 | | 1 | 107 | 72-134 | 05/09/2022 1041 |
| PFHpA | 16 | 14 | | 1 | 87 | 72-130 | 05/09/2022 1041 |
| PFHxA | 16 | 17 | | 1 | 105 | 72-129 | 05/09/2022 1041 |
| PFNA | 16 | 17 | | 1 | 109 | 69-130 | 05/09/2022 1041 |
| PFOA | 16 | 17 | | 1 | 105 | 71-133 | 05/09/2022 1041 |
| PFPeA | 16 | 17 | | 1 | 104 | 72-129 | 05/09/2022 1041 |
| PFTeDA | 16 | 16 | | 1 | 101 | 71-132 | 05/09/2022 1041 |
| PFTrDA | 16 | 17 | | 1 | 105 | 65-144 | 05/09/2022 1041 |
| PFUdA | 16 | 16 | | 1 | 100 | 69-133 | 05/09/2022 1041 |
| PFOS | 15 | 15 | | 1 | 103 | 65-140 | 05/09/2022 1041 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 |
| 13C2_6:2FTS | | 104 | 50-150 |
| 13C2_8:2FTS | | 89 | 50-150 |
| 13C2_PFDoA | | 90 | 50-150 |
| 13C2_PFTeDA | | 93 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 108 | 50-150 |
| 13C5_PFHxA | | 98 | 50-150 |
| 13C5_PFPeA | | 91 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 |
| 13C7_PFUdA | | 95 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ40323-002
Batch: 40323
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/04/2022 1353

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 99 | 50-150 |
| 13C9_PFNA | | 90 | 50-150 |
| d5-EtFOSAA | | 87 | 50-150 |
| d-MeFOSA | | 54 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCSD

Sample ID: XQ40323-003
Batch: 40323
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/04/2022 1353

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 15 | | 1 | 96 | 5.1 | 67-138 | 30 | 05/09/2022 1051 |
| 6:2 FTS | 15 | 14 | | 1 | 90 | 25 | 64-140 | 30 | 05/09/2022 1051 |
| 4:2 FTS | 15 | 14 | | 1 | 96 | 2.6 | 63-143 | 30 | 05/09/2022 1051 |
| EtFOSAA | 16 | 18 | | 1 | 111 | 3.3 | 61-135 | 30 | 05/09/2022 1051 |
| MeFOSA | 16 | 17 | | 1 | 106 | 2.2 | 68-141 | 30 | 05/09/2022 1051 |
| MeFOSAA | 16 | 16 | | 1 | 99 | 2.1 | 65-136 | 30 | 05/09/2022 1051 |
| PFBS | 14 | 14 | | 1 | 97 | 0.86 | 72-130 | 30 | 05/09/2022 1051 |
| PFDS | 15 | 15 | | 1 | 96 | 6.9 | 53-142 | 30 | 05/09/2022 1051 |
| PFHpS | 15 | 16 | | 1 | 103 | 5.5 | 69-134 | 30 | 05/09/2022 1051 |
| PFNS | 15 | 15 | | 1 | 100 | 2.7 | 69-127 | 30 | 05/09/2022 1051 |
| PFOSA | 16 | 16 | | 1 | 99 | 8.1 | 67-137 | 30 | 05/09/2022 1051 |
| PFPeS | 15 | 15 | | 1 | 100 | 2.2 | 71-127 | 30 | 05/09/2022 1051 |
| PFHxS | 15 | 16 | | 1 | 112 | 0.84 | 68-131 | 30 | 05/09/2022 1051 |
| PFBA | 16 | 16 | | 1 | 102 | 1.0 | 73-129 | 30 | 05/09/2022 1051 |
| PFDA | 16 | 19 | | 1 | 117 | 14 | 71-129 | 30 | 05/09/2022 1051 |
| PFDoA | 16 | 16 | | 1 | 100 | 7.1 | 72-134 | 30 | 05/09/2022 1051 |
| PFHpA | 16 | 17 | | 1 | 104 | 18 | 72-130 | 30 | 05/09/2022 1051 |
| PFHxA | 16 | 16 | | 1 | 98 | 7.1 | 72-129 | 30 | 05/09/2022 1051 |
| PFNA | 16 | 17 | | 1 | 109 | 0.056 | 69-130 | 30 | 05/09/2022 1051 |
| PFOA | 16 | 16 | | 1 | 102 | 3.3 | 71-133 | 30 | 05/09/2022 1051 |
| PFPeA | 16 | 16 | | 1 | 103 | 1.0 | 72-129 | 30 | 05/09/2022 1051 |
| PFTeDA | 16 | 16 | | 1 | 101 | 0.17 | 71-132 | 30 | 05/09/2022 1051 |
| PFTrDA | 16 | 18 | | 1 | 110 | 5.0 | 65-144 | 30 | 05/09/2022 1051 |
| PFUdA | 16 | 16 | | 1 | 97 | 3.0 | 69-133 | 30 | 05/09/2022 1051 |
| PFOS | 15 | 15 | | 1 | 104 | 1.4 | 65-140 | 30 | 05/09/2022 1051 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 102 | 50-150 |
| 13C2_6:2FTS | | 108 | 50-150 |
| 13C2_8:2FTS | | 104 | 50-150 |
| 13C2_PFDoA | | 92 | 50-150 |
| 13C2_PFTeDA | | 95 | 50-150 |
| 13C3_PFBS | | 103 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 |
| 13C5_PFHxA | | 98 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 92 | 50-150 |
| 13C7_PFUdA | | 94 | 50-150 |
| 13C8_PFOA | | 106 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCSD

Sample ID: XQ40323-003
Batch: 40323
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/04/2022 1353

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 94 | 50-150 |
| 13C8_PFOSA | | 106 | 50-150 |
| 13C9_PFNA | | 93 | 50-150 |
| d5-EtFOSAA | | 89 | 50-150 |
| d-MeFOSA | | 60 | 50-150 |
| d3-MeFOSAA | | 97 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ40570-001
Batch: 40570
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/05/2022 1625

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/08/2022 1743 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/08/2022 1743 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/08/2022 1743 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/08/2022 1743 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 05/08/2022 1743 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/08/2022 1743 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 104 | 50-150 |
| 13C2_6:2FTS | | 120 | 50-150 |
| 13C2_8:2FTS | | 92 | 50-150 |
| 13C2_PFDoA | | 101 | 50-150 |
| 13C2_PFTeDA | | 88 | 50-150 |
| 13C3_PFBS | | 101 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 104 | 50-150 |
| 13C5_PFHxA | | 97 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ40570-001
Batch: 40570
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/05/2022 1625

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 82 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 |
| 13C9_PFNA | | 92 | 50-150 |
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 59 | 50-150 |
| d3-MeFOSAA | | 97 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ40570-002
Batch: 40570
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/05/2022 1625

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 18 | | 1 | 115 | 67-138 | 05/08/2022 1753 |
| 6:2 FTS | 15 | 14 | | 1 | 95 | 64-140 | 05/08/2022 1753 |
| 4:2 FTS | 15 | 15 | | 1 | 99 | 63-143 | 05/08/2022 1753 |
| EtFOSAA | 16 | 15 | | 1 | 96 | 61-135 | 05/08/2022 1753 |
| MeFOSA | 16 | 18 | | 1 | 113 | 68-141 | 05/08/2022 1753 |
| MeFOSAA | 16 | 15 | | 1 | 94 | 65-136 | 05/08/2022 1753 |
| PFBS | 14 | 15 | | 1 | 105 | 72-130 | 05/08/2022 1753 |
| PFDS | 15 | 14 | | 1 | 88 | 53-142 | 05/08/2022 1753 |
| PFHpS | 15 | 15 | | 1 | 97 | 69-134 | 05/08/2022 1753 |
| PFNS | 15 | 14 | | 1 | 93 | 69-127 | 05/08/2022 1753 |
| PFOSA | 16 | 16 | | 1 | 100 | 67-137 | 05/08/2022 1753 |
| PFPeS | 15 | 15 | | 1 | 100 | 71-127 | 05/08/2022 1753 |
| PFHxS | 15 | 14 | | 1 | 97 | 68-131 | 05/08/2022 1753 |
| PFBA | 16 | 16 | | 1 | 102 | 73-129 | 05/08/2022 1753 |
| PFDA | 16 | 17 | | 1 | 108 | 71-129 | 05/08/2022 1753 |
| PFDoA | 16 | 14 | | 1 | 89 | 72-134 | 05/08/2022 1753 |
| PFHpA | 16 | 17 | | 1 | 107 | 72-130 | 05/08/2022 1753 |
| PFHxA | 16 | 17 | | 1 | 104 | 72-129 | 05/08/2022 1753 |
| PFNA | 16 | 16 | | 1 | 102 | 69-130 | 05/08/2022 1753 |
| PFOA | 16 | 15 | | 1 | 97 | 71-133 | 05/08/2022 1753 |
| PFPeA | 16 | 16 | | 1 | 99 | 72-129 | 05/08/2022 1753 |
| PFTeDA | 16 | 17 | | 1 | 106 | 71-132 | 05/08/2022 1753 |
| PFTrDA | 16 | 15 | | 1 | 94 | 65-144 | 05/08/2022 1753 |
| PFUdA | 16 | 16 | | 1 | 100 | 69-133 | 05/08/2022 1753 |
| PFOS | 15 | 15 | | 1 | 102 | 65-140 | 05/08/2022 1753 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 |
| 13C2_6:2FTS | | 146 | 50-150 |
| 13C2_8:2FTS | | 103 | 50-150 |
| 13C2_PFDoA | | 115 | 50-150 |
| 13C2_PFTeDA | | 96 | 50-150 |
| 13C3_PFBS | | 110 | 50-150 |
| 13C3_PFHxS | | 113 | 50-150 |
| 13C4_PFBA | | 104 | 50-150 |
| 13C4_PFHpA | | 104 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 101 | 50-150 |
| 13C6_PFDA | | 103 | 50-150 |
| 13C7_PFUdA | | 98 | 50-150 |
| 13C8_PFOA | | 108 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ40570-002
Batch: 40570
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/05/2022 1625

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 92 | 50-150 |
| 13C8_PFOSA | | 102 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d5-EtFOSAA | | 95 | 50-150 |
| d-MeFOSA | | 61 | 50-150 |
| d3-MeFOSAA | | 116 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# Chain of Custody
# and
# Miscellaneous Documents

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 111169

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Craig.Divine@arcadis.com, Jesse.Wright@arcadis.com and Kristen.Hasbrouck@arcadis.com | Telephone No. / E-mail: Kristen.Hasbrouck@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: Austin Westhuis | Analysis (Attach list if more space is needed) | Page 1 of 3 |
| City: Novi | State: MI | Zip Code: 48377 | |
| Project Name: ESTEP Vertebrae - Grayling | Printed Name: Austin Westhuis | | Lot # Bar Code: XD16001 |
| Project No.: 30027241.00003 | P.O. No.: | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab / Composite | Matrix: Aqueous | Soil | Other | No. of Containers by Preservative Type: Unpres. | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | Other | PFAS 24 USEPA Method 537 w/ Isotope Dilution (Table 3, 5, 6, 7, 8, 9) | KE62 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-VRTB-3_04132022 | 4/13/22 | 1130 | G | X | | | 2 | | | | | | | X | |
| MW-VRTB-2S_04132022 | 4/13/22 | 1255 | G | X | | | 2 | | | | | | | X | |
| MW-VRTB-2D_04132022 | 4/13/22 | 1350 | G | X | | | 2 | | | | | | | X | |
| Dup-01_04132022 | 4/13/22 | — | G | X | | | 2 | | | | | | | X | |
| MW-VRTB-1S_04132022 | 4/13/22 | 1515 | G | X | | | 2 | | | | | | | X | |
| MW-VRTB-1D_04132022 | 4/13/22 | 1625 | G | X | | | 2 | | | | | | | X | |
| VRTB-L-MS_04132022 | 4/13/22 | 1745 | G | X | | | 2 | | | | | | | X | |
| VRTB-L-06_04142022 | 4/14/22 | 0900 | G | X | | | 2 | | | | | | | X | |
| VRTB-L-P7_04142022 | 4/14/22 | 1020 | G | X | | | 2 | | | | | | | X | |
| VRTB-L-BB8_04142022 | 4/14/22 | 1120 | G | X | | | 2 | | | | | | | X | |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.)
☒ Standard ☐ Rush (Specify)

**Sample Disposal**
☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification**
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis | Date: 4/15/22 | Time: 1600 | 1. Received by: FedEx | Date: 4/15/22 | Time: 1600 |
| 2. Relinquished by | Date | Time | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: FedEx | Date: 4/16/22 | Time: 0850 | 4. Laboratory received by: [illegible] | Date: 4/16/22 | Time: 0850 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle) (Yes) No Ice Pack — Receipt Temp. 2.1 °C — Temp Blank ☒ Y ☐ N

**DISTRIBUTION:** WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME000N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 111170

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Craig Divine, Jesse Wright, and Kristen Hasbrouck | Telephone No. / E-mail: Craig.Divine@arcadis.com; Jesse.Wright@arcadis.com; kristen.Hasbrouck@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x Austin Westhuis | Analysis (Attach list if more space is needed) | Page 2 of 3 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | |
| Project Name: ESTCP Vertebrae - Grayling | | | |
| Project No.: 300 27244.00003 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab/Composite | Matrix: Aqueous | Matrix: Solid | Matrix: Wipe/Other | No. of Containers by Preservative Type: Unpres. | HNO3 | HCl | NaOH | Soln Kit | Other | PFAS 33 USEPA Method 537 mod Isotope Dilution List (Table 2, Table 3, Table 4) | PFAS Top Assay | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-L-B1_04142022 | 4/14/22 | 1325 | G | X | | | 2 | | | | | | X | | |
| VRTB-L-S2_04142022 | 4/14/22 | 1445 | G | X | | | 2 | | | | | | X | | |
| VRTB-L-Y3_04142022 | 4/14/22 | 1530 | G | X | | | 2 | | | | | | X | | |
| VRTB-L-G4_04142022 | 4/14/22 | 1630 | G | X | | | 2 | | | | | | X | | |
| Dup-02_04142022 | 4/14/22 | — | G | X | | | 2 | | | | | | X | | |
| CMT-VRTB-01_7_04152022 | 4/15/22 | 0820 | G | X | | | 6 | | | | | | MS/MSD | X | MS/MSD (Top Assay Only) |
| CMT-VRTB-01_6_04152022 | 4/15/22 | 0905 | G | X | | | 2 | | | | | | | X | |
| CMT-VRTB-01_5_04152022 | 4/15/22 | 0935 | G | X | | | 2 | | | | | | | X | |
| CMT-VRTB-01_4_04152022 | 4/15/22 | 1015 | G | X | | | 2 | | | | | | | X | |
| CMT-VRTB-01_3_04152022 | 4/15/22 | 1045 | G | X | | | 2 | | | | | | | X | |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify)

**Sample Disposal**: ☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification**: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | | | | | |
|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis | Date: 4/15/22 | Time: 1600 | 1. Received by: FedEx | Date: 4/15/22 | Time: 1600 |
| 2. Relinquished by | Date | Time | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: FEDEX | Date: 4/16/22 | Time: 0950 | 4. Laboratory received by: [illegible] | Date: 4/16/22 | Time: 0950 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle): (Yes) No Ice Pack — Receipt Temp: 2.1 °C — Temp Blank: (Y) N

**DISTRIBUTION:** WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01

XD16001



PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 111171

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Craig Divine, Jesse Wright, and Kristen Hasbrouck | Telephone No. / E-mail: Craig.Divine@arcadis.com; Jesse.Wright@arcadis.com; Kristen.Hasbrouck@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x [signature] | Analysis (Attach list if more space is needed) | Page 3 of 3 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | XD16001 |
| Project Name: ESTCP Vertebrae – Grayling | | | KBS2 |
| Project No.: 30027244.00003 | P.O. No. | | Remarks / Cooler I.D. |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab / Composite | Matrix: Aqueous | Matrix: Solid | Matrix: Wipe/Swab | No. of Containers by Preservative Type: Unpres. | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | Other Preserv. | PFAS by USEPA Method 537.1 Modified per ESTCP ER-201912 | PFAS Top Assay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMT-VRTB-01_2_04152022 | 4/15/22 | 1120 | G | X | | | 2 | | | | | | | | X |
| CMT-VRTB-01_1_04152022 | 4/15/22 | 1150 | G | X | | | 2 | | | | | | | | X |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify)

**Sample Disposal**: ☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification**: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | Date | Time |
|---|---|---|
| 1. Relinquished by: [signature] / Austin Westhuis | 4/15/22 | 1600 |
| 2. Relinquished by: | | |
| 3. Relinquished by: | | |
| 4. Relinquished by: FedEx | 4/16/22 | 0450 |

| | Date | Time |
|---|---|---|
| 1. Received by: FedEx | 4/15/22 | 1600 |
| 2. Received by: | | |
| 3. Received by: | | |
| 4. Laboratory received by: [signature] | 4/16/22 | 0450 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

**LAB USE ONLY**
Received on ice (Circle) (Yes) No Ice Pack — Receipt Temp. 2.1 °C — Temp Blank ☒ Y ☐ N

**DISTRIBUTION:** WHITE & YELLOW-Return to laboratory with Sample(s), PINK-Field/Client Copy

Document Number: ME003N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

# Sample Receipt Checklist (SRC)

Client: ARCADIS

Cooler Inspected by/date: KNR / 04/16/2022 Lot #: XD16001

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No | ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: NA

2.1 /2.1 °C NA /NA °C NA /NA °C NA /NA °C

Method: ☑ Temperature Blank ☐ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☐ Yes | ☐ No | ☑ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☑ Yes | ☐ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS? |
| ☑ Yes | ☐ No | | 21. Was the quote number listed on the container label? If yes, Quote # 25221 |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: $H_2SO_4$, $HNO_3$, HCl, NaOH using SR # NA. Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (if #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: KNR Date: 04/16/2022

Comments:

# Report of Analysis

**Arcadis U.S., Inc.**
9954 Mayland Drive
Richmond, VA 23233
Attention: Kristen Hasbrook

Project Name: ESTCP Grayling Vertebrae

Project Number: 30027244.00003

Lot Number:**XD16017**

Date Completed:05/19/2022

05/26/2022 11:29 AM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: XD16017

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

Samples XD16017-002 required centrifugation prior to extraction, due to excessive solids present in the samples. Centrifugation was performed following the PFAS Aqueous Centrifuge Protocol; samples were spiked with Surrogate (SUR; Extracted Internal Standard/EIS) and shaken vigorously before being poured into a conical bottle and centrifuged. The centrifuged aqueous sample was decanted back into the original sample bottle, off of the condensed solids remaining in the centrifuge bottle. Original sample bottle was rinsed as normal and centrifuge bottle was rinsed with 4mL of MeOH. Centrifuge bottle rinsate was added to the elution. Samples concentrated to <5mL and reconstituted to 5mL using MeOH by transfer pipet.

Surrogate recovery for the following samples was outside the upper control limit: XD16017-001, XD16017-002, XD16017-003, XD16017-006, XD16017-008.

Surrogate recovery for the following sample was outside control limits: XD16017-005. Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

The MS/MSD associated with sample XD16017-003 had PFOS recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

## Sample Summary
## Arcadis U.S., Inc.
Lot Number: XD16017

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | VRTB-D-06_04132022 | Aqueous | 04/13/2022 1345 | 04/16/2022 |
| 002 | VRTB-D-P8_04132022 | Aqueous | 04/13/2022 1346 | 04/16/2022 |
| 003 | VRTB-D-M5_04132022 | Aqueous | 04/13/2022 1512 | 04/16/2022 |
| 004 | VRTB-D-R7_04132022 | Aqueous | 04/13/2022 1633 | 04/16/2022 |
| 005 | VRTB-D-B1_04142022 | Aqueous | 04/14/2022 1048 | 04/16/2022 |
| 006 | VRTB-D-S2_04142022 | Aqueous | 04/14/2022 1213 | 04/16/2022 |
| 007 | VRTB-D-G4_04142022 | Aqueous | 04/14/2022 1220 | 04/16/2022 |
| 008 | VRTB-D-Y3_04142022 | Aqueous | 04/14/2022 1353 | 04/16/2022 |
| 009 | VRTB-S-B1_04142022 | Aqueous | 04/14/2022 1747 | 04/16/2022 |
| 010 | VRTB-S-S2_04142022 | Aqueous | 04/14/2022 1553 | 04/16/2022 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | 04/14/2022 1755 | 04/16/2022 |
| 012 | VRTB-S-G4_04142022 | Aqueous | 04/14/2022 1530 | 04/16/2022 |
| 013 | VRTB-S-06_04142022 | Aqueous | 04/15/2022 1142 | 04/16/2022 |

(13 samples)

# Detection Summary

## Arcadis U.S., Inc.

### Lot Number: XD16017

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | VRTB-D-06_04132022 | Aqueous | PFBS | PFAS by ID | 2.9 | J | ng/L | 9 |
| 001 | VRTB-D-06_04132022 | Aqueous | PFHpS | PFAS by ID | 7.7 | | ng/L | 9 |
| 001 | VRTB-D-06_04132022 | Aqueous | PFPeS | PFAS by ID | 4.6 | | ng/L | 9 |
| 001 | VRTB-D-06_04132022 | Aqueous | PFHxS | PFAS by ID | 79 | | ng/L | 9 |
| 001 | VRTB-D-06_04132022 | Aqueous | PFBA | PFAS by ID | 6.2 | | ng/L | 9 |
| 001 | VRTB-D-06_04132022 | Aqueous | PFHpA | PFAS by ID | 5.9 | | ng/L | 9 |
| 001 | VRTB-D-06_04132022 | Aqueous | PFHxA | PFAS by ID | 9.9 | | ng/L | 9 |
| 001 | VRTB-D-06_04132022 | Aqueous | PFNA | PFAS by ID | 1.2 | J | ng/L | 9 |
| 001 | VRTB-D-06_04132022 | Aqueous | PFOA | PFAS by ID | 8.8 | | ng/L | 9 |
| 001 | VRTB-D-06_04132022 | Aqueous | PFPeA | PFAS by ID | 10 | | ng/L | 9 |
| 001 | VRTB-D-06_04132022 | Aqueous | PFOS | PFAS by ID | 290 | | ng/L | 9 |
| 002 | VRTB-D-P8_04132022 | Aqueous | PFBS | PFAS by ID | 4.8 | | ng/L | 11 |
| 002 | VRTB-D-P8_04132022 | Aqueous | PFHpS | PFAS by ID | 3.1 | J | ng/L | 11 |
| 002 | VRTB-D-P8_04132022 | Aqueous | PFPeS | PFAS by ID | 3.1 | J | ng/L | 11 |
| 002 | VRTB-D-P8_04132022 | Aqueous | PFHxS | PFAS by ID | 78 | | ng/L | 11 |
| 002 | VRTB-D-P8_04132022 | Aqueous | PFBA | PFAS by ID | 11 | | ng/L | 11 |
| 002 | VRTB-D-P8_04132022 | Aqueous | PFHpA | PFAS by ID | 21 | | ng/L | 11 |
| 002 | VRTB-D-P8_04132022 | Aqueous | PFHxA | PFAS by ID | 21 | | ng/L | 11 |
| 002 | VRTB-D-P8_04132022 | Aqueous | PFNA | PFAS by ID | 4.5 | | ng/L | 11 |
| 002 | VRTB-D-P8_04132022 | Aqueous | PFOA | PFAS by ID | 18 | | ng/L | 11 |
| 002 | VRTB-D-P8_04132022 | Aqueous | PFPeA | PFAS by ID | 26 | | ng/L | 11 |
| 002 | VRTB-D-P8_04132022 | Aqueous | PFOS | PFAS by ID | 190 | | ng/L | 11 |
| 003 | VRTB-D-M5_04132022 | Aqueous | PFBS | PFAS by ID | 3.8 | J | ng/L | 13 |
| 003 | VRTB-D-M5_04132022 | Aqueous | PFHpS | PFAS by ID | 4.0 | | ng/L | 13 |
| 003 | VRTB-D-M5_04132022 | Aqueous | PFPeS | PFAS by ID | 2.9 | J | ng/L | 13 |
| 003 | VRTB-D-M5_04132022 | Aqueous | PFHxS | PFAS by ID | 68 | | ng/L | 13 |
| 003 | VRTB-D-M5_04132022 | Aqueous | PFBA | PFAS by ID | 5.9 | | ng/L | 13 |
| 003 | VRTB-D-M5_04132022 | Aqueous | PFHpA | PFAS by ID | 4.9 | | ng/L | 13 |
| 003 | VRTB-D-M5_04132022 | Aqueous | PFHxA | PFAS by ID | 12 | | ng/L | 13 |
| 003 | VRTB-D-M5_04132022 | Aqueous | PFOA | PFAS by ID | 5.0 | | ng/L | 13 |
| 003 | VRTB-D-M5_04132022 | Aqueous | PFPeA | PFAS by ID | 12 | | ng/L | 13 |
| 003 | VRTB-D-M5_04132022 | Aqueous | PFOS | PFAS by ID | 310 | S | ng/L | 13 |
| 004 | VRTB-D-R7_04132022 | Aqueous | PFBS | PFAS by ID | 2.4 | J | ng/L | 15 |
| 004 | VRTB-D-R7_04132022 | Aqueous | PFHpS | PFAS by ID | 2.0 | J | ng/L | 15 |
| 004 | VRTB-D-R7_04132022 | Aqueous | PFPeS | PFAS by ID | 1.5 | J | ng/L | 15 |
| 004 | VRTB-D-R7_04132022 | Aqueous | PFHxS | PFAS by ID | 48 | | ng/L | 15 |
| 004 | VRTB-D-R7_04132022 | Aqueous | PFBA | PFAS by ID | 10 | | ng/L | 15 |
| 004 | VRTB-D-R7_04132022 | Aqueous | PFHpA | PFAS by ID | 20 | | ng/L | 15 |
| 004 | VRTB-D-R7_04132022 | Aqueous | PFHxA | PFAS by ID | 15 | | ng/L | 15 |
| 004 | VRTB-D-R7_04132022 | Aqueous | PFNA | PFAS by ID | 1.8 | J | ng/L | 15 |
| 004 | VRTB-D-R7_04132022 | Aqueous | PFOA | PFAS by ID | 10 | | ng/L | 15 |
| 004 | VRTB-D-R7_04132022 | Aqueous | PFPeA | PFAS by ID | 20 | | ng/L | 15 |
| 004 | VRTB-D-R7_04132022 | Aqueous | PFOS | PFAS by ID | 120 | | ng/L | 15 |
| 005 | VRTB-D-B1_04142022 | Aqueous | 8:2 FTS | PFAS by ID | 2.5 | J | ng/L | 17 |
| 005 | VRTB-D-B1_04142022 | Aqueous | 6:2 FTS | PFAS by ID | 3.5 | JQ | ng/L | 17 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 005 | VRTB-D-B1_04142022 | Aqueous | PFBS | PFAS by ID | 16 | | ng/L | 17 |
| 005 | VRTB-D-B1_04142022 | Aqueous | PFHpS | PFAS by ID | 12 | | ng/L | 17 |
| 005 | VRTB-D-B1_04142022 | Aqueous | PFPeS | PFAS by ID | 19 | | ng/L | 17 |
| 005 | VRTB-D-B1_04142022 | Aqueous | PFHxS | PFAS by ID | 260 | | ng/L | 17 |
| 005 | VRTB-D-B1_04142022 | Aqueous | PFBA | PFAS by ID | 18 | | ng/L | 17 |
| 005 | VRTB-D-B1_04142022 | Aqueous | PFHpA | PFAS by ID | 14 | | ng/L | 17 |
| 005 | VRTB-D-B1_04142022 | Aqueous | PFHxA | PFAS by ID | 31 | | ng/L | 17 |
| 005 | VRTB-D-B1_04142022 | Aqueous | PFNA | PFAS by ID | 4.9 | | ng/L | 17 |
| 005 | VRTB-D-B1_04142022 | Aqueous | PFOA | PFAS by ID | 30 | | ng/L | 17 |
| 005 | VRTB-D-B1_04142022 | Aqueous | PFPeA | PFAS by ID | 24 | | ng/L | 17 |
| 005 | VRTB-D-B1_04142022 | Aqueous | PFOS | PFAS by ID | 1100 | | ng/L | 17 |
| 006 | VRTB-D-S2_04142022 | Aqueous | PFBS | PFAS by ID | 12 | | ng/L | 19 |
| 006 | VRTB-D-S2_04142022 | Aqueous | PFHpS | PFAS by ID | 6.1 | | ng/L | 19 |
| 006 | VRTB-D-S2_04142022 | Aqueous | PFPeS | PFAS by ID | 19 | | ng/L | 19 |
| 006 | VRTB-D-S2_04142022 | Aqueous | PFHxS | PFAS by ID | 150 | | ng/L | 19 |
| 006 | VRTB-D-S2_04142022 | Aqueous | PFBA | PFAS by ID | 7.1 | | ng/L | 19 |
| 006 | VRTB-D-S2_04142022 | Aqueous | PFHpA | PFAS by ID | 6.6 | | ng/L | 19 |
| 006 | VRTB-D-S2_04142022 | Aqueous | PFHxA | PFAS by ID | 17 | | ng/L | 19 |
| 006 | VRTB-D-S2_04142022 | Aqueous | PFNA | PFAS by ID | 1.1 | J | ng/L | 19 |
| 006 | VRTB-D-S2_04142022 | Aqueous | PFOA | PFAS by ID | 19 | | ng/L | 19 |
| 006 | VRTB-D-S2_04142022 | Aqueous | PFPeA | PFAS by ID | 9.7 | | ng/L | 19 |
| 006 | VRTB-D-S2_04142022 | Aqueous | PFOS | PFAS by ID | 220 | | ng/L | 19 |
| 007 | VRTB-D-G4_04142022 | Aqueous | PFBS | PFAS by ID | 1.1 | J | ng/L | 21 |
| 007 | VRTB-D-G4_04142022 | Aqueous | PFHpS | PFAS by ID | 1.5 | J | ng/L | 21 |
| 007 | VRTB-D-G4_04142022 | Aqueous | PFPeS | PFAS by ID | 1.2 | J | ng/L | 21 |
| 007 | VRTB-D-G4_04142022 | Aqueous | PFHxS | PFAS by ID | 37 | | ng/L | 21 |
| 007 | VRTB-D-G4_04142022 | Aqueous | PFBA | PFAS by ID | 7.3 | | ng/L | 21 |
| 007 | VRTB-D-G4_04142022 | Aqueous | PFHpA | PFAS by ID | 4.5 | | ng/L | 21 |
| 007 | VRTB-D-G4_04142022 | Aqueous | PFHxA | PFAS by ID | 13 | | ng/L | 21 |
| 007 | VRTB-D-G4_04142022 | Aqueous | PFOA | PFAS by ID | 3.7 | J | ng/L | 21 |
| 007 | VRTB-D-G4_04142022 | Aqueous | PFPeA | PFAS by ID | 20 | | ng/L | 21 |
| 007 | VRTB-D-G4_04142022 | Aqueous | PFOS | PFAS by ID | 100 | | ng/L | 21 |
| 008 | VRTB-D-Y3_04142022 | Aqueous | PFBS | PFAS by ID | 3.4 | J | ng/L | 23 |
| 008 | VRTB-D-Y3_04142022 | Aqueous | PFHpS | PFAS by ID | 2.2 | J | ng/L | 23 |
| 008 | VRTB-D-Y3_04142022 | Aqueous | PFPeS | PFAS by ID | 7.0 | | ng/L | 23 |
| 008 | VRTB-D-Y3_04142022 | Aqueous | PFHxS | PFAS by ID | 66 | | ng/L | 23 |
| 008 | VRTB-D-Y3_04142022 | Aqueous | PFBA | PFAS by ID | 4.7 | | ng/L | 23 |
| 008 | VRTB-D-Y3_04142022 | Aqueous | PFHpA | PFAS by ID | 2.6 | J | ng/L | 23 |
| 008 | VRTB-D-Y3_04142022 | Aqueous | PFHxA | PFAS by ID | 4.1 | | ng/L | 23 |
| 008 | VRTB-D-Y3_04142022 | Aqueous | PFOA | PFAS by ID | 6.1 | | ng/L | 23 |
| 008 | VRTB-D-Y3_04142022 | Aqueous | PFPeA | PFAS by ID | 3.6 | J | ng/L | 23 |
| 008 | VRTB-D-Y3_04142022 | Aqueous | PFOS | PFAS by ID | 120 | | ng/L | 23 |
| 009 | VRTB-S-B1_04142022 | Aqueous | PFBS | PFAS by ID | 2.8 | J | ng/L | 25 |
| 009 | VRTB-S-B1_04142022 | Aqueous | PFPeS | PFAS by ID | 1.6 | J | ng/L | 25 |
| 009 | VRTB-S-B1_04142022 | Aqueous | PFHxS | PFAS by ID | 24 | | ng/L | 25 |
| 009 | VRTB-S-B1_04142022 | Aqueous | PFBA | PFAS by ID | 2.1 | J | ng/L | 25 |
| 009 | VRTB-S-B1_04142022 | Aqueous | PFHxA | PFAS by ID | 1.3 | J | ng/L | 25 |
| 009 | VRTB-S-B1_04142022 | Aqueous | PFOA | PFAS by ID | 1.6 | J | ng/L | 25 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 009 | VRTB-S-B1_04142022 | Aqueous | PFPeA | PFAS by ID | 1.2 | J | ng/L | 25 |
| 009 | VRTB-S-B1_04142022 | Aqueous | PFOS | PFAS by ID | 130 | | ng/L | 25 |
| 010 | VRTB-S-S2_04142022 | Aqueous | PFBS | PFAS by ID | 5.0 | | ng/L | 27 |
| 010 | VRTB-S-S2_04142022 | Aqueous | PFHpS | PFAS by ID | 6.6 | | ng/L | 27 |
| 010 | VRTB-S-S2_04142022 | Aqueous | PFPeS | PFAS by ID | 6.4 | | ng/L | 27 |
| 010 | VRTB-S-S2_04142022 | Aqueous | PFHxS | PFAS by ID | 130 | | ng/L | 27 |
| 010 | VRTB-S-S2_04142022 | Aqueous | PFBA | PFAS by ID | 7.5 | | ng/L | 27 |
| 010 | VRTB-S-S2_04142022 | Aqueous | PFHpA | PFAS by ID | 12 | | ng/L | 27 |
| 010 | VRTB-S-S2_04142022 | Aqueous | PFHxA | PFAS by ID | 10 | | ng/L | 27 |
| 010 | VRTB-S-S2_04142022 | Aqueous | PFNA | PFAS by ID | 3.1 | J | ng/L | 27 |
| 010 | VRTB-S-S2_04142022 | Aqueous | PFOA | PFAS by ID | 19 | | ng/L | 27 |
| 010 | VRTB-S-S2_04142022 | Aqueous | PFPeA | PFAS by ID | 8.3 | | ng/L | 27 |
| 010 | VRTB-S-S2_04142022 | Aqueous | PFOS | PFAS by ID | 680 | | ng/L | 27 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | 8:2 FTS | PFAS by ID | 4.0 | J | ng/L | 29 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | PFBS | PFAS by ID | 8.9 | | ng/L | 29 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | PFHpS | PFAS by ID | 18 | | ng/L | 29 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | PFPeS | PFAS by ID | 19 | | ng/L | 29 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | PFHxS | PFAS by ID | 410 | | ng/L | 29 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | PFBA | PFAS by ID | 10 | | ng/L | 29 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | PFHpA | PFAS by ID | 14 | | ng/L | 29 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | PFHxA | PFAS by ID | 28 | | ng/L | 29 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | PFNA | PFAS by ID | 3.6 | J | ng/L | 29 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | PFOA | PFAS by ID | 19 | | ng/L | 29 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | PFPeA | PFAS by ID | 17 | | ng/L | 29 |
| 011 | VRTB-S-Y3_04142022 | Aqueous | PFOS | PFAS by ID | 1200 | | ng/L | 29 |
| 012 | VRTB-S-G4_04142022 | Aqueous | PFBS | PFAS by ID | 12 | | ng/L | 31 |
| 012 | VRTB-S-G4_04142022 | Aqueous | PFHpS | PFAS by ID | 28 | | ng/L | 31 |
| 012 | VRTB-S-G4_04142022 | Aqueous | PFPeS | PFAS by ID | 25 | | ng/L | 31 |
| 012 | VRTB-S-G4_04142022 | Aqueous | PFHxS | PFAS by ID | 530 | | ng/L | 31 |
| 012 | VRTB-S-G4_04142022 | Aqueous | PFBA | PFAS by ID | 9.0 | | ng/L | 31 |
| 012 | VRTB-S-G4_04142022 | Aqueous | PFHpA | PFAS by ID | 12 | | ng/L | 31 |
| 012 | VRTB-S-G4_04142022 | Aqueous | PFHxA | PFAS by ID | 32 | | ng/L | 31 |
| 012 | VRTB-S-G4_04142022 | Aqueous | PFNA | PFAS by ID | 1.8 | J | ng/L | 31 |
| 012 | VRTB-S-G4_04142022 | Aqueous | PFOA | PFAS by ID | 18 | | ng/L | 31 |
| 012 | VRTB-S-G4_04142022 | Aqueous | PFPeA | PFAS by ID | 11 | | ng/L | 31 |
| 012 | VRTB-S-G4_04142022 | Aqueous | PFOS | PFAS by ID | 1200 | | ng/L | 31 |
| 013 | VRTB-S-06_04142022 | Aqueous | 8:2 FTS | PFAS by ID | 2.4 | J | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | 6:2 FTS | PFAS by ID | 2.5 | J | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | PFBS | PFAS by ID | 11 | | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | PFHpS | PFAS by ID | 34 | | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | PFOSA | PFAS by ID | 3.4 | J | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | PFPeS | PFAS by ID | 22 | | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | PFHxS | PFAS by ID | 400 | | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | PFBA | PFAS by ID | 12 | | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | PFHpA | PFAS by ID | 19 | | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | PFHxA | PFAS by ID | 31 | | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | PFNA | PFAS by ID | 5.9 | | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | PFOA | PFAS by ID | 41 | | ng/L | 33 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 013 | VRTB-S-06_04142022 | Aqueous | PFPeA | PFAS by ID | 16 | | ng/L | 33 |
| 013 | VRTB-S-06_04142022 | Aqueous | PFOS | PFAS by ID | 2000 | | ng/L | 33 |

(143 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-001
Description: VRTB-D-06_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1345
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/03/2022 1234 | MMM | 04/21/2022 1104 | 38894 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | UQ | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.9 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.7 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 4.6 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 79 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.2 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 5.9 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 9.9 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.2 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 8.8 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 10 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 290 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 |
| 13C2_6:2FTS | N | 161 | 50-150 |
| 13C2_8:2FTS | | 103 | 50-150 |
| 13C2_PFDoA | | 94 | 50-150 |
| 13C2_PFTeDA | | 76 | 50-150 |
| 13C3_PFBS | | 101 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 |
| 13C3-HFPO-DA | | 97 | 50-150 |
| 13C4_PFBA | | 99 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 |
| 13C5_PFPeA | | 105 | 50-150 |
| 13C6_PFDA | | 116 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-001
Description: VRTB-D-06_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1345
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C8_PFOA | | 108 | 50-150 |
| 13C8_PFOS | | 94 | 50-150 |
| 13C8_PFOSA | | 96 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |
| d-EtFOSA | | 75 | 50-150 |
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 82 | 50-150 |
| d3-MeFOSAA | | 95 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-002
Description: VRTB-D-P8_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1346
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/03/2022 1245 | MMM | 04/21/2022 1104 | 38894 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/08/2022 1825 | MMM | 05/05/2022 1625 | 40570 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | UQ | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | UQ | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.8 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 3.1 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 3.1 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 78 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 11 | | 4.0 | 2.0 | 1.0 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 21 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 21 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 4.5 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 26 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 190 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 174 | 50-150 | | 130 | 50-150 |
| 13C2_6:2FTS | N | 172 | 50-150 | | 136 | 50-150 |
| 13C2_8:2FTS | | 112 | 50-150 | | 112 | 50-150 |
| 13C2_PFDoA | | 97 | 50-150 | | 97 | 50-150 |
| 13C2_PFTeDA | | 71 | 50-150 | | 66 | 50-150 |
| 13C3_PFBS | | 106 | 50-150 | | 101 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 | | 100 | 50-150 |
| 13C3-HFPO-DA | | 105 | 50-150 | | 109 | 50-150 |
| 13C4_PFBA | N | 49 | 50-150 | | 60 | 50-150 |
| 13C4_PFHpA | | 106 | 50-150 | | 99 | 50-150 |
| 13C5_PFHxA | | 111 | 50-150 | | 104 | 50-150 |
| 13C5_PFPeA | | 110 | 50-150 | | 102 | 50-150 |
| 13C6_PFDA | | 107 | 50-150 | | 102 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-002
Description: VRTB-D-P8_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1346
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C7_PFUdA | | 102 | 50-150 | | 91 | 50-150 |
| 13C8_PFOA | | 114 | 50-150 | | 97 | 50-150 |
| 13C8_PFOS | | 107 | 50-150 | | 85 | 50-150 |
| 13C8_PFOSA | | 105 | 50-150 | | 103 | 50-150 |
| 13C9_PFNA | | 112 | 50-150 | | 100 | 50-150 |
| d-EtFOSA | | 91 | 50-150 | | 105 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 | | 97 | 50-150 |
| d-MeFOSA | | 107 | 50-150 | | 99 | 50-150 |
| d3-MeFOSAA | | 107 | 50-150 | | 105 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16017-003
Description: VRTB-D-M5_04132022 | Matrix: Aqueous
Date Sampled: 04/13/2022 1512
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/03/2022 1255 | MMM | 04/21/2022 1104 | 38894 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | UQ | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 3.8 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 4.0 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.9 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 68 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 5.9 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 4.9 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 12 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 5.0 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 12 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 310 | S | 4.0 | 2.0 | 1.0 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 109 | 50-150 |
| 13C2_6:2FTS | N | 162 | 50-150 |
| 13C2_8:2FTS | | 111 | 50-150 |
| 13C2_PFDoA | | 110 | 50-150 |
| 13C2_PFTeDA | | 78 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 |
| 13C3_PFHxS | | 90 | 50-150 |
| 13C3-HFPO-DA | | 105 | 50-150 |
| 13C4_PFBA | | 100 | 50-150 |
| 13C4_PFHpA | | 98 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 109 | 50-150 |
| 13C7_PFUdA | | 100 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-003
Description: VRTB-D-M5_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1512
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C8_PFOA | | 120 | 50-150 |
| 13C8_PFOS | | 97 | 50-150 |
| 13C8_PFOSA | | 106 | 50-150 |
| 13C9_PFNA | | 100 | 50-150 |
| d-EtFOSA | | 86 | 50-150 |
| d5-EtFOSAA | | 103 | 50-150 |
| d-MeFOSA | | 107 | 50-150 |
| d3-MeFOSAA | | 98 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-004
Description: VRTB-D-R7_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1633
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/03/2022 1317 | MMM | 04/21/2022 1104 | 38894 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.4 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.0 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.5 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 48 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 10 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 20 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 15 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | J | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 10 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 20 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 120 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 130 | 50-150 |
| 13C2_6:2FTS | | 60 | 50-150 |
| 13C2_8:2FTS | | 109 | 50-150 |
| 13C2_PFDoA | | 107 | 50-150 |
| 13C2_PFTeDA | | 74 | 50-150 |
| 13C3_PFBS | | 104 | 50-150 |
| 13C3_PFHxS | | 98 | 50-150 |
| 13C3-HFPO-DA | | 112 | 50-150 |
| 13C4_PFBA | | 108 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 110 | 50-150 |
| 13C5_PFPeA | | 109 | 50-150 |
| 13C6_PFDA | | 111 | 50-150 |
| 13C7_PFUdA | | 98 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-004
Description: VRTB-D-R7_04132022
Matrix: Aqueous
Date Sampled: 04/13/2022 1633
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C8_PFOA | | 121 | 50-150 |
| 13C8_PFOS | | 108 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 |
| 13C9_PFNA | | 120 | 50-150 |
| d-EtFOSA | | 82 | 50-150 |
| d5-EtFOSAA | | 107 | 50-150 |
| d-MeFOSA | | 93 | 50-150 |
| d3-MeFOSAA | | 105 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-005
Description: VRTB-D-B1_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1048
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 05/04/2022 1107 | MMM | 04/21/2022 1104 | 38894 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/04/2022 1118 | MMM | 04/21/2022 1104 | 38894 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 2.5 | J | 8.2 | 4.1 | 2.0 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | JQ | 8.2 | 4.1 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.0 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.0 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.0 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.0 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.1 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.0 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 16 | | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 12 | | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 19 | | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 260 | | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 18 | | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 14 | | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 31 | | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 4.9 | | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 30 | | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 24 | | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | UQ | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1100 | | 20 | 10 | 5.1 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 151 | 50-150 | | 141 | 50-150 |
| 13C2_6:2FTS | | 132 | 50-150 | N | 164 | 50-150 |
| 13C2_8:2FTS | | 113 | 50-150 | | 104 | 50-150 |
| 13C2_PFDoA | | 97 | 50-150 | | 90 | 50-150 |
| 13C2_PFTeDA | | 55 | 50-150 | N | 45 | 50-150 |
| 13C3_PFBS | | 115 | 50-150 | | 99 | 50-150 |
| 13C3_PFHxS | | 112 | 50-150 | | 95 | 50-150 |
| 13C3-HFPO-DA | | 108 | 50-150 | | 95 | 50-150 |
| 13C4_PFBA | | 79 | 50-150 | | 64 | 50-150 |
| 13C4_PFHpA | | 113 | 50-150 | | 97 | 50-150 |
| 13C5_PFHxA | | 97 | 50-150 | | 91 | 50-150 |
| 13C5_PFPeA | | 115 | 50-150 | | 96 | 50-150 |
| 13C6_PFDA | | 113 | 50-150 | | 96 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-005
Description: VRTB-D-B1_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1048
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C7_PFUdA | | 108 | 50-150 | | 93 | 50-150 |
| 13C8_PFOA | | 117 | 50-150 | | 102 | 50-150 |
| 13C8_PFOS | | 101 | 50-150 | | 86 | 50-150 |
| 13C8_PFOSA | | 110 | 50-150 | | 91 | 50-150 |
| 13C9_PFNA | | 100 | 50-150 | | 77 | 50-150 |
| d-EtFOSA | | 109 | 50-150 | | 88 | 50-150 |
| d5-EtFOSAA | | 110 | 50-150 | | 99 | 50-150 |
| d-MeFOSA | | 119 | 50-150 | | 93 | 50-150 |
| d3-MeFOSAA | | 106 | 50-150 | | 94 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16017-006
Description: VRTB-D-S2_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1213
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/03/2022 1338 | MMM | 04/21/2022 1104 | 38894 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.8 | U | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.8 | UQ | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 3.8 | U | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.8 | U | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 3.8 | U | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 3.8 | U | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.8 | U | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.5 | U | 15 | 7.5 | 3.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.8 | U | 7.6 | 3.8 | 1.9 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 12 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 6.1 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 19 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 150 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 7.1 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 6.6 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 17 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.1 | J | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 19 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 9.7 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.9 | U | 3.8 | 1.9 | 0.95 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 220 | | 3.8 | 1.9 | 0.95 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 117 | 50-150 |
| 13C2_6:2FTS | N | 176 | 50-150 |
| 13C2_8:2FTS | | 112 | 50-150 |
| 13C2_PFDoA | | 94 | 50-150 |
| 13C2_PFTeDA | | 61 | 50-150 |
| 13C3_PFBS | | 105 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 |
| 13C3-HFPO-DA | | 106 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 98 | 50-150 |
| 13C5_PFPeA | | 105 | 50-150 |
| 13C6_PFDA | | 109 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-006
Description: VRTB-D-S2_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1213
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C8_PFOA | | 112 | 50-150 |
| 13C8_PFOS | | 107 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 |
| 13C9_PFNA | | 100 | 50-150 |
| d-EtFOSA | | 61 | 50-150 |
| d5-EtFOSAA | | 98 | 50-150 |
| d-MeFOSA | | 83 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16017-007
Description: VRTB-D-G4_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1220
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2135 | MMM | 04/21/2022 1104 | 38894 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.1 | 4.1 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.1 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.5 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.2 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 37 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 7.3 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 4.5 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 13 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 3.7 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 20 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 100 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 |
| 13C2_6:2FTS | | 143 | 50-150 |
| 13C2_8:2FTS | | 90 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 |
| 13C2_PFTeDA | | 70 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C3-HFPO-DA | | 91 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 98 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 |
| 13C6_PFDA | | 95 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-007
Description: VRTB-D-G4_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1220
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C8_PFOA | | 94 | 50-150 |
| 13C8_PFOS | | 87 | 50-150 |
| 13C8_PFOSA | | 84 | 50-150 |
| 13C9_PFNA | | 91 | 50-150 |
| d-EtFOSA | | 79 | 50-150 |
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 89 | 50-150 |
| d3-MeFOSAA | | 95 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16017-008
Description: VRTB-D-Y3_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1353
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/02/2022 2146 | MMM | 04/21/2022 1104 | 38894 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.1 | UQ | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 3.4 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.2 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 7.0 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 66 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 4.7 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 2.6 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 4.1 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 6.1 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 3.6 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 120 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 |
| 13C2_6:2FTS | N | 154 | 50-150 |
| 13C2_8:2FTS | | 85 | 50-150 |
| 13C2_PFDoA | | 81 | 50-150 |
| 13C2_PFTeDA | | 58 | 50-150 |
| 13C3_PFBS | | 82 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 |
| 13C3-HFPO-DA | | 88 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 92 | 50-150 |
| 13C5_PFHxA | | 92 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 |
| 13C7_PFUdA | | 84 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-008
Description: VRTB-D-Y3_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1353
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C8_PFOA | | 99 | 50-150 |
| 13C8_PFOS | | 83 | 50-150 |
| 13C8_PFOSA | | 86 | 50-150 |
| 13C9_PFNA | | 88 | 50-150 |
| d-EtFOSA | | 73 | 50-150 |
| d5-EtFOSAA | | 80 | 50-150 |
| d-MeFOSA | | 83 | 50-150 |
| d3-MeFOSAA | | 91 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD16017-009
Description: VRTB-S-B1_04142022 | Matrix: Aqueous
Date Sampled: 04/14/2022 1747
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/27/2022 2229 | ASD | 04/21/2022 1616 | 38971 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 7.9 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.8 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.6 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 24 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 2.1 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 1.3 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 1.6 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 1.2 | J | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 0.99 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 130 | | 4.0 | 2.0 | 0.99 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 115 | 50-150 |
| 13C2_6:2FTS | | 111 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 |
| 13C2_PFDoA | | 93 | 50-150 |
| 13C2_PFTeDA | | 83 | 50-150 |
| 13C3_PFBS | | 102 | 50-150 |
| 13C3_PFHxS | | 99 | 50-150 |
| 13C3-HFPO-DA | | 98 | 50-150 |
| 13C4_PFBA | | 102 | 50-150 |
| 13C4_PFHpA | | 92 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 |
| 13C5_PFPeA | | 104 | 50-150 |
| 13C6_PFDA | | 99 | 50-150 |
| 13C7_PFUdA | | 92 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-009
Description: VRTB-S-B1_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1747
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C8_PFOA | | 105 | 50-150 |
| 13C8_PFOS | | 99 | 50-150 |
| 13C8_PFOSA | | 94 | 50-150 |
| 13C9_PFNA | | 97 | 50-150 |
| d-EtFOSA | | 87 | 50-150 |
| d5-EtFOSAA | | 96 | 50-150 |
| d-MeFOSA | | 81 | 50-150 |
| d3-MeFOSAA | | 95 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-010
Description: VRTB-S-S2_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1553
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/27/2022 2251 | ASD | 04/21/2022 1616 | 38971 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 04/28/2022 1834 | ASD | 04/21/2022 1616 | 38971 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.2 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 5.0 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 6.6 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 6.4 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 130 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 7.5 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 12 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 10 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 3.1 | J | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 19 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 8.3 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 680 | | 21 | 11 | 5.3 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 130 | 50-150 | | 107 | 50-150 |
| 13C2_6:2FTS | | 114 | 50-150 | | 109 | 50-150 |
| 13C2_8:2FTS | | 90 | 50-150 | | 99 | 50-150 |
| 13C2_PFDoA | | 91 | 50-150 | | 88 | 50-150 |
| 13C2_PFTeDA | | 69 | 50-150 | | 71 | 50-150 |
| 13C3_PFBS | | 102 | 50-150 | | 103 | 50-150 |
| 13C3_PFHxS | | 98 | 50-150 | | 108 | 50-150 |
| 13C3-HFPO-DA | | 104 | 50-150 | | 102 | 50-150 |
| 13C4_PFBA | | 104 | 50-150 | | 105 | 50-150 |
| 13C4_PFHpA | | 100 | 50-150 | | 102 | 50-150 |
| 13C5_PFHxA | | 107 | 50-150 | | 102 | 50-150 |
| 13C5_PFPeA | | 106 | 50-150 | | 104 | 50-150 |
| 13C6_PFDA | | 95 | 50-150 | | 95 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-010
Description: VRTB-S-S2_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1553
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C7_PFUdA | | 95 | 50-150 | | 98 | 50-150 |
| 13C8_PFOA | | 110 | 50-150 | | 104 | 50-150 |
| 13C8_PFOS | | 91 | 50-150 | | 97 | 50-150 |
| 13C8_PFOSA | | 95 | 50-150 | | 106 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 | | 107 | 50-150 |
| d-EtFOSA | | 82 | 50-150 | | 94 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 | | 96 | 50-150 |
| d-MeFOSA | | 85 | 50-150 | | 94 | 50-150 |
| d3-MeFOSAA | | 99 | 50-150 | | 101 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-011
Description: VRTB-S-Y3_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1755
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/27/2022 2302 | ASD | 04/21/2022 1616 | 38971 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 04/28/2022 1845 | ASD | 04/21/2022 1616 | 38971 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.0 | J | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 8.9 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 18 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 19 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 410 | | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 10 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 14 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 28 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 3.6 | J | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 19 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 17 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1200 | | 41 | 21 | 10 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 118 | 50-150 | | 86 | 50-150 |
| 13C2_6:2FTS | | 117 | 50-150 | | 91 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 | | 84 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 | | 70 | 50-150 |
| 13C2_PFTeDA | | 81 | 50-150 | | 69 | 50-150 |
| 13C3_PFBS | | 101 | 50-150 | | 80 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 | | 87 | 50-150 |
| 13C3-HFPO-DA | | 103 | 50-150 | | 83 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 | | 81 | 50-150 |
| 13C4_PFHpA | | 101 | 50-150 | | 84 | 50-150 |
| 13C5_PFHxA | | 107 | 50-150 | | 82 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 | | 84 | 50-150 |
| 13C6_PFDA | | 98 | 50-150 | | 80 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-011
Description: VRTB-S-Y3_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1755
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C7_PFUdA | | 94 | 50-150 | | 78 | 50-150 |
| 13C8_PFOA | | 106 | 50-150 | | 83 | 50-150 |
| 13C8_PFOS | | 91 | 50-150 | | 77 | 50-150 |
| 13C8_PFOSA | | 91 | 50-150 | | 80 | 50-150 |
| 13C9_PFNA | | 93 | 50-150 | | 83 | 50-150 |
| d-EtFOSA | | 79 | 50-150 | | 72 | 50-150 |
| d5-EtFOSAA | | 96 | 50-150 | | 76 | 50-150 |
| d-MeFOSA | | 85 | 50-150 | | 79 | 50-150 |
| d3-MeFOSAA | | 96 | 50-150 | | 78 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-012
Description: VRTB-S-G4_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1530
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/27/2022 2335 | ASD | 04/21/2022 1616 | 38971 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 04/28/2022 1856 | ASD | 04/21/2022 1616 | 38971 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 3.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.9 | U | 7.8 | 3.9 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 12 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 28 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 25 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 530 | | 39 | 20 | 9.8 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 9.0 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 12 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 32 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | J | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 11 | | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 3.9 | 2.0 | 0.98 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1200 | | 39 | 20 | 9.8 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 125 | 50-150 | | 73 | 50-150 |
| 13C2_6:2FTS | | 110 | 50-150 | | 84 | 50-150 |
| 13C2_8:2FTS | | 101 | 50-150 | | 72 | 50-150 |
| 13C2_PFDoA | | 94 | 50-150 | | 65 | 50-150 |
| 13C2_PFTeDA | | 90 | 50-150 | | 58 | 50-150 |
| 13C3_PFBS | | 105 | 50-150 | | 72 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 | | 81 | 50-150 |
| 13C3-HFPO-DA | | 102 | 50-150 | | 70 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 | | 73 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 | | 70 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 | | 73 | 50-150 |
| 13C5_PFPeA | | 105 | 50-150 | | 75 | 50-150 |
| 13C6_PFDA | | 98 | 50-150 | | 70 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-012
Description: VRTB-S-G4_04142022
Matrix: Aqueous
Date Sampled: 04/14/2022 1530
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C7_PFUdA | | 101 | 50-150 | | 72 | 50-150 |
| 13C8_PFOA | | 107 | 50-150 | | 75 | 50-150 |
| 13C8_PFOS | | 96 | 50-150 | | 67 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 | | 69 | 50-150 |
| 13C9_PFNA | | 96 | 50-150 | | 74 | 50-150 |
| d-EtFOSA | | 85 | 50-150 | | 70 | 50-150 |
| d5-EtFOSAA | | 98 | 50-150 | | 63 | 50-150 |
| d-MeFOSA | | 89 | 50-150 | | 81 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 | | 75 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-013
Description: VRTB-S-06_04142022
Matrix: Aqueous
Date Sampled: 04/15/2022 1142
Date Received: 04/16/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 04/27/2022 2357 | ASD | 04/21/2022 1616 | 38971 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 05/17/2022 1438 | ASD | 04/21/2022 1616 | 38971 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 2.4 | J | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 2.5 | J | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2 FTS) | 120226-60-0 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (GenX) | 13252-13-6 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamide (EtFOSA) | 4151-50-2 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.2 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 11 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 34 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 3.4 | J | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 22 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 400 | | 42 | 21 | 11 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 12 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 19 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 31 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 5.9 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 41 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 16 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2000 | | 42 | 21 | 11 | ng/L | 3 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 120 | 50-150 | | 102 | 50-150 |
| 13C2_6:2FTS | | 110 | 50-150 | | 88 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 | | 99 | 50-150 |
| 13C2_PFDoA | | 98 | 50-150 | | 89 | 50-150 |
| 13C2_PFTeDA | | 94 | 50-150 | | 88 | 50-150 |
| 13C3_PFBS | | 107 | 50-150 | | 104 | 50-150 |
| 13C3_PFHxS | | 98 | 50-150 | | 99 | 50-150 |
| 13C3-HFPO-DA | | 106 | 50-150 | | 97 | 50-150 |
| 13C4_PFBA | | 108 | 50-150 | | 99 | 50-150 |
| 13C4_PFHpA | | 107 | 50-150 | | 105 | 50-150 |
| 13C5_PFHxA | | 111 | 50-150 | | 97 | 50-150 |
| 13C5_PFPeA | | 107 | 50-150 | | 96 | 50-150 |
| 13C6_PFDA | | 105 | 50-150 | | 98 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD16017-013
Description: VRTB-S-06_04142022
Matrix: Aqueous
Date Sampled: 04/15/2022 1142
Date Received: 04/16/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C7_PFUdA | | 104 | 50-150 | | 94 | 50-150 |
| 13C8_PFOA | | 108 | 50-150 | | 91 | 50-150 |
| 13C8_PFOS | | 92 | 50-150 | | 88 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 | | 102 | 50-150 |
| 13C9_PFNA | | 97 | 50-150 | | 100 | 50-150 |
| d-EtFOSA | | 87 | 50-150 | | 81 | 50-150 |
| d5-EtFOSAA | | 100 | 50-150 | | 95 | 50-150 |
| d-MeFOSA | | 88 | 50-150 | | 96 | 50-150 |
| d3-MeFOSAA | | 101 | 50-150 | | 96 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: XQ38894-001
Batch: 38894
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1104

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1213 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1213 |
| 10:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1213 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1213 |
| GenX | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1213 |
| EtFOSA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1213 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1213 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 05/03/2022 1213 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1213 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1213 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 98 | 50-150 |
| 13C2_6:2FTS | | 146 | 50-150 |
| 13C2_8:2FTS | | 88 | 50-150 |
| 13C2_PFDoA | | 92 | 50-150 |
| 13C2_PFTeDA | | 73 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 |
| 13C3_PFHxS | | 82 | 50-150 |
| 13C3-HFPO-DA | | 89 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 |
| 13C4_PFHpA | | 85 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ38894-001
Batch: 38894
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1104

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C6_PFDA | | 91 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 108 | 50-150 |
| 13C8_PFOS | | 88 | 50-150 |
| 13C8_PFOSA | | 93 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d-EtFOSA | | 77 | 50-150 |
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 77 | 50-150 |
| d3-MeFOSAA | | 84 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ38894-002
Batch: 38894
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1104

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 17 | | 1 | 113 | 67-138 | 05/03/2022 1224 |
| 6:2 FTS | 15 | 13 | | 1 | 83 | 64-140 | 05/03/2022 1224 |
| 10:2 FTS | 15 | 14 | | 1 | 92 | 70-150 | 05/03/2022 1224 |
| 4:2 FTS | 15 | 15 | | 1 | 99 | 63-143 | 05/03/2022 1224 |
| GenX | 32 | 36 | | 1 | 112 | 70-150 | 05/03/2022 1224 |
| EtFOSA | 16 | 16 | | 1 | 99 | 70-150 | 05/03/2022 1224 |
| EtFOSAA | 16 | 16 | | 1 | 99 | 61-135 | 05/03/2022 1224 |
| MeFOSA | 16 | 19 | | 1 | 118 | 68-141 | 05/03/2022 1224 |
| MeFOSAA | 16 | 15 | | 1 | 96 | 65-136 | 05/03/2022 1224 |
| PFBS | 14 | 14 | | 1 | 98 | 72-130 | 05/03/2022 1224 |
| PFDS | 15 | 15 | | 1 | 97 | 53-142 | 05/03/2022 1224 |
| PFHpS | 15 | 18 | | 1 | 116 | 69-134 | 05/03/2022 1224 |
| PFNS | 15 | 14 | | 1 | 93 | 69-127 | 05/03/2022 1224 |
| PFOSA | 16 | 17 | | 1 | 105 | 67-137 | 05/03/2022 1224 |
| PFPeS | 15 | 15 | | 1 | 101 | 71-127 | 05/03/2022 1224 |
| PFHxS | 15 | 15 | | 1 | 101 | 68-131 | 05/03/2022 1224 |
| PFBA | 16 | 17 | | 1 | 105 | 73-129 | 05/03/2022 1224 |
| PFDA | 16 | 17 | | 1 | 108 | 71-129 | 05/03/2022 1224 |
| PFDoA | 16 | 18 | | 1 | 114 | 72-134 | 05/03/2022 1224 |
| PFHpA | 16 | 17 | | 1 | 105 | 72-130 | 05/03/2022 1224 |
| PFHxA | 16 | 18 | | 1 | 110 | 72-129 | 05/03/2022 1224 |
| PFNA | 16 | 18 | | 1 | 115 | 69-130 | 05/03/2022 1224 |
| PFOA | 16 | 16 | | 1 | 102 | 71-133 | 05/03/2022 1224 |
| PFPeA | 16 | 16 | | 1 | 99 | 72-129 | 05/03/2022 1224 |
| PFTeDA | 16 | 18 | | 1 | 110 | 71-132 | 05/03/2022 1224 |
| PFTrDA | 16 | 17 | | 1 | 104 | 65-144 | 05/03/2022 1224 |
| PFUdA | 16 | 17 | | 1 | 108 | 69-133 | 05/03/2022 1224 |
| PFOS | 15 | 15 | | 1 | 101 | 65-140 | 05/03/2022 1224 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 101 | 50-150 |
| 13C2_6:2FTS | N | 151 | 50-150 |
| 13C2_8:2FTS | | 86 | 50-150 |
| 13C2_PFDoA | | 89 | 50-150 |
| 13C2_PFTeDA | | 82 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 |
| 13C3-HFPO-DA | | 88 | 50-150 |
| 13C4_PFBA | | 105 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 |
| 13C5_PFPeA | | 105 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ38894-002
Batch: 38894
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1104

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C6_PFDA | | 96 | 50-150 |
| 13C7_PFUdA | | 90 | 50-150 |
| 13C8_PFOA | | 110 | 50-150 |
| 13C8_PFOS | | 98 | 50-150 |
| 13C8_PFOSA | | 92 | 50-150 |
| 13C9_PFNA | | 88 | 50-150 |
| d-EtFOSA | | 61 | 50-150 |
| d5-EtFOSAA | | 91 | 50-150 |
| d-MeFOSA | | 65 | 50-150 |
| d3-MeFOSAA | | 90 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XD16017-003MS
Batch: 38894
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1104

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | 15 | 16 | | 1 | 105 | 67-138 | 05/03/2022 1306 |
| 6:2 FTS | ND | 15 | 15 | | 1 | 104 | 64-140 | 05/03/2022 1306 |
| 10:2 FTS | ND | 15 | 15 | | 1 | 99 | 70-150 | 05/03/2022 1306 |
| 4:2 FTS | ND | 15 | 16 | | 1 | 113 | 63-143 | 05/03/2022 1306 |
| GenX | ND | 31 | 33 | | 1 | 106 | 70-150 | 05/03/2022 1306 |
| EtFOSA | ND | 16 | 17 | | 1 | 107 | 70-150 | 05/03/2022 1306 |
| EtFOSAA | ND | 16 | 16 | | 1 | 100 | 61-135 | 05/03/2022 1306 |
| MeFOSA | ND | 16 | 16 | | 1 | 101 | 68-141 | 05/03/2022 1306 |
| MeFOSAA | ND | 16 | 16 | | 1 | 101 | 65-136 | 05/03/2022 1306 |
| PFBS | 3.8 | 14 | 17 | | 1 | 92 | 72-130 | 05/03/2022 1306 |
| PFDS | ND | 15 | 16 | | 1 | 104 | 53-142 | 05/03/2022 1306 |
| PFHpS | 4.0 | 15 | 20 | | 1 | 111 | 69-134 | 05/03/2022 1306 |
| PFNS | ND | 15 | 14 | | 1 | 96 | 69-127 | 05/03/2022 1306 |
| PFOSA | ND | 16 | 18 | | 1 | 114 | 67-137 | 05/03/2022 1306 |
| PFPeS | 2.9 | 15 | 19 | | 1 | 107 | 71-127 | 05/03/2022 1306 |
| PFHxS | 68 | 14 | 83 | | 1 | 107 | 68-131 | 05/03/2022 1306 |
| PFBA | 5.9 | 16 | 21 | | 1 | 99 | 73-129 | 05/03/2022 1306 |
| PFDA | ND | 16 | 17 | | 1 | 106 | 71-129 | 05/03/2022 1306 |
| PFDoA | ND | 16 | 18 | | 1 | 113 | 72-134 | 05/03/2022 1306 |
| PFHpA | 4.9 | 16 | 21 | | 1 | 102 | 72-130 | 05/03/2022 1306 |
| PFHxA | 12 | 16 | 24 | | 1 | 81 | 72-129 | 05/03/2022 1306 |
| PFNA | ND | 16 | 17 | | 1 | 108 | 69-130 | 05/03/2022 1306 |
| PFOA | 5.0 | 16 | 20 | | 1 | 99 | 71-133 | 05/03/2022 1306 |
| PFPeA | 12 | 16 | 26 | | 1 | 88 | 72-129 | 05/03/2022 1306 |
| PFTeDA | ND | 16 | 15 | | 1 | 98 | 71-132 | 05/03/2022 1306 |
| PFTrDA | ND | 16 | 18 | | 1 | 117 | 65-144 | 05/03/2022 1306 |
| PFUdA | ND | 16 | 16 | | 1 | 103 | 69-133 | 05/03/2022 1306 |
| PFOS | 310 | 15 | 290 | N | 1 | -185 | 65-140 | 05/03/2022 1306 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 |
| 13C2_6:2FTS | N | 154 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 |
| 13C2_PFDoA | | 89 | 50-150 |
| 13C2_PFTeDA | | 72 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 |
| 13C3_PFHxS | | 86 | 50-150 |
| 13C3-HFPO-DA | | 98 | 50-150 |
| 13C4_PFBA | | 96 | 50-150 |
| 13C4_PFHpA | | 98 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 105 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XD16017-003MS
Batch: 38894
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1104

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C6_PFDA | | 100 | 50-150 |
| 13C7_PFUdA | | 98 | 50-150 |
| 13C8_PFOA | | 108 | 50-150 |
| 13C8_PFOS | | 102 | 50-150 |
| 13C8_PFOSA | | 91 | 50-150 |
| 13C9_PFNA | | 94 | 50-150 |
| d-EtFOSA | | 76 | 50-150 |
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 95 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: XD16017-008DU
Batch: 38894
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1104

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| 6:2 FTS | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| 10:2 FTS | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| 4:2 FTS | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| GenX | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| EtFOSA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| EtFOSAA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| MeFOSA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| MeFOSAA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| PFBS | 3.4 | 3.4 | J | 1 | 0.59 | 20 | 05/02/2022 2156 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| PFHpS | 2.2 | 1.9 | J | 1 | 14 | 20 | 05/02/2022 2156 |
| PFNS | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| PFOSA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| PFPeS | 7.0 | 7.1 | | 1 | 0.90 | 20 | 05/02/2022 2156 |
| PFHxS | 66 | 61 | | 1 | 7.9 | 20 | 05/02/2022 2156 |
| PFBA | 4.7 | 4.4 | | 1 | 6.0 | 20 | 05/02/2022 2156 |
| PFDA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| PFHpA | 2.6 | 2.6 | J | 1 | 3.6 | 20 | 05/02/2022 2156 |
| PFHxA | 4.1 | 4.2 | | 1 | 2.7 | 20 | 05/02/2022 2156 |
| PFNA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| PFOA | 6.1 | 6.4 | | 1 | 5.0 | 20 | 05/02/2022 2156 |
| PFPeA | 3.6 | 3.6 | J | 1 | 0.24 | 20 | 05/02/2022 2156 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| PFUdA | ND | ND | | 1 | 0.00 | 20 | 05/02/2022 2156 |
| PFOS | 120 | 120 | | 1 | 3.4 | 20 | 05/02/2022 2156 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 95 | 50-150 |
| 13C2_6:2FTS | | 143 | 50-150 |
| 13C2_8:2FTS | | 84 | 50-150 |
| 13C2_PFDoA | | 90 | 50-150 |
| 13C2_PFTeDA | | 58 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 |
| 13C3-HFPO-DA | | 92 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 97 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: XD16017-008DU
Batch: 38894
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1104

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C6_PFDA | | 92 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 96 | 50-150 |
| 13C8_PFOS | | 90 | 50-150 |
| 13C8_PFOSA | | 84 | 50-150 |
| 13C9_PFNA | | 92 | 50-150 |
| d-EtFOSA | | 71 | 50-150 |
| d5-EtFOSAA | | 98 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ38971-001
Batch: 38971
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1616

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2156 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2156 |
| 10:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2156 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2156 |
| GenX | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2156 |
| EtFOSA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2156 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2156 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 04/27/2022 2156 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2156 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2156 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 |
| 13C2_6:2FTS | | 106 | 50-150 |
| 13C2_8:2FTS | | 89 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 |
| 13C2_PFTeDA | | 72 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 |
| 13C3_PFHxS | | 89 | 50-150 |
| 13C3-HFPO-DA | | 95 | 50-150 |
| 13C4_PFBA | | 94 | 50-150 |
| 13C4_PFHpA | | 92 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ38971-001
Batch: 38971
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1616

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C6_PFDA | | 85 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 |
| 13C8_PFOA | | 105 | 50-150 |
| 13C8_PFOS | | 96 | 50-150 |
| 13C8_PFOSA | | 90 | 50-150 |
| 13C9_PFNA | | 96 | 50-150 |
| d-EtFOSA | | 75 | 50-150 |
| d5-EtFOSAA | | 87 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ38971-002
Batch: 38971
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1616

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 14 | | 1 | 90 | 67-138 | 04/27/2022 2207 |
| 6:2 FTS | 15 | 16 | | 1 | 109 | 64-140 | 04/27/2022 2207 |
| 10:2 FTS | 15 | 14 | | 1 | 89 | 70-150 | 04/27/2022 2207 |
| 4:2 FTS | 15 | 14 | | 1 | 96 | 63-143 | 04/27/2022 2207 |
| GenX | 32 | 28 | | 1 | 87 | 70-150 | 04/27/2022 2207 |
| EtFOSA | 16 | 17 | | 1 | 107 | 70-150 | 04/27/2022 2207 |
| EtFOSAA | 16 | 15 | | 1 | 97 | 61-135 | 04/27/2022 2207 |
| MeFOSA | 16 | 13 | | 1 | 84 | 68-141 | 04/27/2022 2207 |
| MeFOSAA | 16 | 15 | | 1 | 94 | 65-136 | 04/27/2022 2207 |
| PFBS | 14 | 13 | | 1 | 95 | 72-130 | 04/27/2022 2207 |
| PFDS | 15 | 13 | | 1 | 87 | 53-142 | 04/27/2022 2207 |
| PFHpS | 15 | 14 | | 1 | 91 | 69-134 | 04/27/2022 2207 |
| PFNS | 15 | 14 | | 1 | 91 | 69-127 | 04/27/2022 2207 |
| PFOSA | 16 | 14 | | 1 | 89 | 67-137 | 04/27/2022 2207 |
| PFPeS | 15 | 14 | | 1 | 93 | 71-127 | 04/27/2022 2207 |
| PFHxS | 15 | 13 | | 1 | 88 | 68-131 | 04/27/2022 2207 |
| PFBA | 16 | 16 | | 1 | 100 | 73-129 | 04/27/2022 2207 |
| PFDA | 16 | 15 | | 1 | 97 | 71-129 | 04/27/2022 2207 |
| PFDoA | 16 | 16 | | 1 | 97 | 72-134 | 04/27/2022 2207 |
| PFHpA | 16 | 15 | | 1 | 94 | 72-130 | 04/27/2022 2207 |
| PFHxA | 16 | 15 | | 1 | 94 | 72-129 | 04/27/2022 2207 |
| PFNA | 16 | 15 | | 1 | 95 | 69-130 | 04/27/2022 2207 |
| PFOA | 16 | 15 | | 1 | 95 | 71-133 | 04/27/2022 2207 |
| PFPeA | 16 | 16 | | 1 | 98 | 72-129 | 04/27/2022 2207 |
| PFTeDA | 16 | 15 | | 1 | 96 | 71-132 | 04/27/2022 2207 |
| PFTrDA | 16 | 15 | | 1 | 95 | 65-144 | 04/27/2022 2207 |
| PFUdA | 16 | 15 | | 1 | 96 | 69-133 | 04/27/2022 2207 |
| PFOS | 15 | 13 | | 1 | 90 | 65-140 | 04/27/2022 2207 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 106 | 50-150 |
| 13C2_6:2FTS | | 111 | 50-150 |
| 13C2_8:2FTS | | 99 | 50-150 |
| 13C2_PFDoA | | 94 | 50-150 |
| 13C2_PFTeDA | | 93 | 50-150 |
| 13C3_PFBS | | 103 | 50-150 |
| 13C3_PFHxS | | 107 | 50-150 |
| 13C3-HFPO-DA | | 106 | 50-150 |
| 13C4_PFBA | | 101 | 50-150 |
| 13C4_PFHpA | | 100 | 50-150 |
| 13C5_PFHxA | | 107 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ38971-002
Batch: 38971
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1616

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C6_PFDA | | 97 | 50-150 |
| 13C7_PFUdA | | 98 | 50-150 |
| 13C8_PFOA | | 110 | 50-150 |
| 13C8_PFOS | | 104 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 105 | 50-150 |
| d-EtFOSA | | 79 | 50-150 |
| d5-EtFOSAA | | 100 | 50-150 |
| d-MeFOSA | | 77 | 50-150 |
| d3-MeFOSAA | | 99 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XD16017-009MS
Batch: 38971
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1616

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | 15 | 15 | | 1 | 98 | 67-138 | 04/27/2022 2240 |
| 6:2 FTS | ND | 15 | 15 | | 1 | 103 | 64-140 | 04/27/2022 2240 |
| 10:2 FTS | ND | 15 | 14 | | 1 | 91 | 70-150 | 04/27/2022 2240 |
| 4:2 FTS | ND | 15 | 15 | | 1 | 99 | 63-143 | 04/27/2022 2240 |
| GenX | ND | 32 | 30 | | 1 | 95 | 70-150 | 04/27/2022 2240 |
| EtFOSA | ND | 16 | 18 | | 1 | 114 | 70-150 | 04/27/2022 2240 |
| EtFOSAA | ND | 16 | 16 | | 1 | 98 | 61-135 | 04/27/2022 2240 |
| MeFOSA | ND | 16 | 16 | | 1 | 102 | 68-141 | 04/27/2022 2240 |
| MeFOSAA | ND | 16 | 16 | | 1 | 100 | 65-136 | 04/27/2022 2240 |
| PFBS | 2.8 | 14 | 17 | | 1 | 101 | 72-130 | 04/27/2022 2240 |
| PFDS | ND | 15 | 15 | | 1 | 97 | 53-142 | 04/27/2022 2240 |
| PFHpS | ND | 15 | 16 | | 1 | 108 | 69-134 | 04/27/2022 2240 |
| PFNS | ND | 15 | 14 | | 1 | 94 | 69-127 | 04/27/2022 2240 |
| PFOSA | ND | 16 | 16 | | 1 | 99 | 67-137 | 04/27/2022 2240 |
| PFPeS | 1.6 | 15 | 17 | | 1 | 102 | 71-127 | 04/27/2022 2240 |
| PFHxS | 24 | 14 | 38 | | 1 | 101 | 68-131 | 04/27/2022 2240 |
| PFBA | 2.1 | 16 | 18 | | 1 | 98 | 73-129 | 04/27/2022 2240 |
| PFDA | ND | 16 | 16 | | 1 | 100 | 71-129 | 04/27/2022 2240 |
| PFDoA | ND | 16 | 16 | | 1 | 99 | 72-134 | 04/27/2022 2240 |
| PFHpA | ND | 16 | 17 | | 1 | 104 | 72-130 | 04/27/2022 2240 |
| PFHxA | 1.3 | 16 | 17 | | 1 | 100 | 72-129 | 04/27/2022 2240 |
| PFNA | ND | 16 | 15 | | 1 | 96 | 69-130 | 04/27/2022 2240 |
| PFOA | 1.6 | 16 | 17 | | 1 | 100 | 71-133 | 04/27/2022 2240 |
| PFPeA | 1.2 | 16 | 17 | | 1 | 102 | 72-129 | 04/27/2022 2240 |
| PFTeDA | ND | 16 | 16 | | 1 | 103 | 71-132 | 04/27/2022 2240 |
| PFTrDA | ND | 16 | 15 | | 1 | 95 | 65-144 | 04/27/2022 2240 |
| PFUdA | ND | 16 | 16 | | 1 | 102 | 69-133 | 04/27/2022 2240 |
| PFOS | 130 | 15 | 150 | | 1 | 121 | 65-140 | 04/27/2022 2240 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 |
| 13C2_6:2FTS | | 120 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 |
| 13C2_PFDoA | | 100 | 50-150 |
| 13C2_PFTeDA | | 88 | 50-150 |
| 13C3_PFBS | | 104 | 50-150 |
| 13C3_PFHxS | | 105 | 50-150 |
| 13C3-HFPO-DA | | 107 | 50-150 |
| 13C4_PFBA | | 107 | 50-150 |
| 13C4_PFHpA | | 106 | 50-150 |
| 13C5_PFHxA | | 106 | 50-150 |
| 13C5_PFPeA | | 107 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XD16017-009MS
Batch: 38971
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1616

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C6_PFDA | | 102 | 50-150 |
| 13C7_PFUdA | | 100 | 50-150 |
| 13C8_PFOA | | 111 | 50-150 |
| 13C8_PFOS | | 100 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 109 | 50-150 |
| d-EtFOSA | | 84 | 50-150 |
| d5-EtFOSAA | | 104 | 50-150 |
| d-MeFOSA | | 90 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: XD16017-012DU
Batch: 38971
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1616

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| 6:2 FTS | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| 10:2 FTS | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| 4:2 FTS | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| GenX | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| EtFOSA | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| EtFOSAA | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| MeFOSA | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| MeFOSAA | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| PFBS | 12 | 13 | | 1 | 6.4 | 20 | 04/27/2022 2346 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| PFHpS | 28 | 28 | | 1 | 1.6 | 20 | 04/27/2022 2346 |
| PFNS | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| PFOSA | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| PFPeS | 25 | 26 | | 1 | 6.6 | 20 | 04/27/2022 2346 |
| PFHxS | 610 | 610 | E | 1 | 0.66 | 20 | 04/27/2022 2346 |
| PFBA | 9.0 | 9.2 | | 1 | 2.6 | 20 | 04/27/2022 2346 |
| PFDA | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| PFHpA | 12 | 12 | | 1 | 3.0 | 20 | 04/27/2022 2346 |
| PFHxA | 32 | 33 | | 1 | 3.1 | 20 | 04/27/2022 2346 |
| PFNA | 1.8 | 2.0 | J | 1 | 12 | 20 | 04/27/2022 2346 |
| PFOA | 18 | 17 | | 1 | 6.1 | 20 | 04/27/2022 2346 |
| PFPeA | 11 | 11 | | 1 | 3.2 | 20 | 04/27/2022 2346 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| PFUdA | ND | ND | | 1 | 0.00 | 20 | 04/27/2022 2346 |
| PFOS | 1200 | 1200 | E | 1 | 1.0 | 20 | 04/27/2022 2346 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 125 | 50-150 |
| 13C2_6:2FTS | | 113 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 |
| 13C2_PFDoA | | 91 | 50-150 |
| 13C2_PFTeDA | | 85 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 |
| 13C3-HFPO-DA | | 99 | 50-150 |
| 13C4_PFBA | | 102 | 50-150 |
| 13C4_PFHpA | | 96 | 50-150 |
| 13C5_PFHxA | | 102 | 50-150 |
| 13C5_PFPeA | | 103 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: XD16017-012DU
Batch: 38971
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/21/2022 1616

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C6_PFDA | | 96 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 |
| 13C8_PFOA | | 105 | 50-150 |
| 13C8_PFOS | | 94 | 50-150 |
| 13C8_PFOSA | | 95 | 50-150 |
| 13C9_PFNA | | 91 | 50-150 |
| d-EtFOSA | | 86 | 50-150 |
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 88 | 50-150 |
| d3-MeFOSAA | | 97 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ40570-001
Batch: 40570
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/05/2022 1625

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/08/2022 1743 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 104 | 50-150 |
| 13C2_6:2FTS | | 120 | 50-150 |
| 13C2_8:2FTS | | 92 | 50-150 |
| 13C2_PFDoA | | 101 | 50-150 |
| 13C2_PFTeDA | | 88 | 50-150 |
| 13C3_PFBS | | 101 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 |
| 13C3-HFPO-DA | | 114 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 104 | 50-150 |
| 13C5_PFHxA | | 97 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 |
| 13C8_PFOS | | 82 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 |
| 13C9_PFNA | | 92 | 50-150 |
| d-EtFOSA | | 54 | 50-150 |
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 59 | 50-150 |
| d3-MeFOSAA | | 97 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ40570-002
Batch: 40570
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 05/05/2022 1625

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| PFBA | 16 | 16 | | 1 | 102 | 73-129 | 05/08/2022 1753 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 |
| 13C2_6:2FTS | | 146 | 50-150 |
| 13C2_8:2FTS | | 103 | 50-150 |
| 13C2_PFDoA | | 115 | 50-150 |
| 13C2_PFTeDA | | 96 | 50-150 |
| 13C3_PFBS | | 110 | 50-150 |
| 13C3_PFHxS | | 113 | 50-150 |
| 13C3-HFPO-DA | | 106 | 50-150 |
| 13C4_PFBA | | 104 | 50-150 |
| 13C4_PFHpA | | 104 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 101 | 50-150 |
| 13C6_PFDA | | 103 | 50-150 |
| 13C7_PFUdA | | 98 | 50-150 |
| 13C8_PFOA | | 108 | 50-150 |
| 13C8_PFOS | | 92 | 50-150 |
| 13C8_PFOSA | | 102 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d-EtFOSA | | 64 | 50-150 |
| d5-EtFOSAA | | 95 | 50-150 |
| d-MeFOSA | | 61 | 50-150 |
| d3-MeFOSAA | | 116 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 111168

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Craig Divine, Jesse Wright, Kristen Hasbrouck | Telephone No. / E-mail: @arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: | Analysis (Attach list if more space is needed) | Page 1 of 2 |
| City: Novi | State: MI | Zip Code: 48377 | Printed Name: Kristen Hasbrouck | | XD16017 |
| Project Name: ESTCP Grayling Vertebrae | | | KES2 |
| Project No.: 30027244.0003 | P.O. No. | | Remarks / Cooler I.D. |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab/Composite | Matrix: Aqueous | Soil | Wipe/Sponge | No. of Containers by Preservative Type: Unpres. | HCl/04 | HNO3 | H2SO4 | NaOH | Na2S2O3 | Other Preserved | PFAS - QSM Table B-15 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-D-06_04132022 | 4/13/22 | 1345 | G | X | | | 2 | | | | | | | X | Old as in Orange (2 not zero) |
| VRTB-D-PB_04132022 | 4/13/22 | 1346 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-MS_04132022 | 4/13/22 | 1512 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-R7_04132022 | 4/13/22 | 1633 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-B1_04142022 | 4/14/22 | 1048 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-S2_04142022 | 4/14/22 | 1213 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-G4_04142022 | 4/14/22 | 1220 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-Y3_04142022 | 4/14/22 | 1355 | G | X | | | 2 | | | | | | | X | |
| VRTB-S-B1_04142022 | 4/14/22 | 1747 | G | X | | | 2 | | | | | | | X | |
| VRTB-S-S2_04142022 | 4/14/22 | 1553 | G | X | | | 2 | | | | | | | X | |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.): [X] Standard [ ] Rush (Specify)

**Sample Disposal:** [ ] Return to Client [X] Disposal by Lab

**Possible Hazard Identification:** [X] Non-Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison [ ] Unknown

**QC Requirements (Specify):** Level II

| | Date | Time |
|---|---|---|
| 1. Relinquished by: Kristen Hasbrouck | 4/15/22 | 1300 |
| 2. Relinquished by: Austin Westhuis | 4/15/22 | 1600 |
| 3. Relinquished by: | Date | Time |
| 4. Relinquished by: | 4/16/22 | 0950 |

| | Date | Time |
|---|---|---|
| 1. Received by: Austin Westhuis | 4/15/22 | 1300 |
| 2. Received by: Fedex | 4/15/22 | 1600 |
| 3. Received by: | Date | Time |
| 4. Laboratory received by: | 4/16/22 | 0950 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

**LAB USE ONLY**
Received on ice (Circle): (Yes) No Ice Pack — Receipt Temp: 4.2 °C — Temp Blank: [X] Y [ ] N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: MF003N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 128459

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Craig Divine, Jesse Wright, Kristen Hasbrouck | Telephone No. / E-mail: @arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: | Analysis (Attach list if more space is needed) | Page 2 of 2 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Kristen Hasbrouck | | XD16017 |
| Project Name: ESTCP Grayling Vertebrae | | | KES2 |
| Project No.: 30027244.00003 | P.O. No. | | Remarks / Cooler I.D. |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | SeaGrab Composite | Matrix: Aqueous | Matrix: Soil | Matrix: Wipe / Swab | No. of Containers by Preservative Type: Unpres. | HCSO4 | HNO3 | HCl | NaOH | NaOH/ZnAc | Methanol | PFAS - QSM Table B-15 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-S-Y3_04142022 | 4/14/22 | 1755 | G | X | | | 2 | | | | | | | X | |
| VRTB-S-G4_04142022 | 4/14/22 | 1530 | G | X | | | 2 | | | | | | | X | |
| VRTB-S-06_04152022 | 4/15/22 | 1142 | G | X | | | 2 | | | | | | | X | One in Orange Cooler |

| | | | |
|---|---|---|---|
| Turn Around Time Required (Prior lab approval required for expedited TAT.): X Standard; Rush (Specify) | Sample Disposal: ☐ Return to Client; X Disposal by Lab | Possible Hazard Identification: X Non-Hazard; ☐ Flammable; ☐ Skin Irritant; ☐ Poison; ☐ Unknown | QC Requirements (Specify): Level II |
| 1. Relinquished by: Kristen Hasbrouck | Date: 4/15/22 Time: 1300 | 1. Received by: Austin Westhuis | Date: 4/15/22 Time: 1300 |
| 2. Relinquished by: Austin Westhuis | Date: 4/15/22 Time: 1600 | 2. Received by: FedEx | Date: 4/15/22 Time: 1600 |
| 3. Relinquished by: | Date: Time: | 3. Received by: | Date: Time: |
| 4. Relinquished by: FedEx | Date: 4/16/22 Time: 0450 | 4. Laboratory received by: | Date: 4/16/22 Time: 0450 |
| Note: All samples are retained for four weeks from receipt unless other arrangements are made. | | LAB USE ONLY — Received on Ice (Circle): Yes / No; Ice Pack | Receipt Temp: 4.2 °C; Temp Blank: Y / N |

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

# Sample Receipt Checklist (SRC)

Client: Arcadis  Cooler Inspected by/date: KSC / 04/16/2022  Lot #: XD16017

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No | ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: NA

4.2 / 4.2 °C  NA / NA °C  NA / NA °C  NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles  IR Gun ID: 5  IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☐ Yes | ☐ No | ☑ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☐ Yes | ☑ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼" or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS? |
| ☑ Yes | ☐ No | | 21. Was the quote number listed on the container label? If yes, Quote # 225014 |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: KSC  Date: 04/16/2022

Comments:

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

Lot Number:**XD23008**

Date Completed:05/14/2022

Project Manager:**Kathy E. Smith**



05/16/2022 8:32 AM
Approved and released by:
Project Manager II: **Edward Barnett**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: XD23008

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report. Where sampling is conducted by the client, results relate to the accuracy of the information provided, and as the samples are received.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

**PFAS**

d3-MeFOSA surrogate recovery for the MB associated with the following sample was outside the lower control limit XD23008-003. The MB did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

The laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for prep batch 39495 exceeded acceptance criteria for 13C5_PFHxA and 13C8-PFOA surrogate. The associated target analyte passed, therefore the data were reported: XC24069-

Due to Analyst error, LCS for prep batch 39495, 39496, and 39497 was spiked with .2 mL of SURR prior to sample extraction.

XD23008-003 (VRTB-S-R7_04192022) (Run 1) (Analysis Batch 40750) (Prep Batch 39495) DOD List PFAS by Isotope Dilution (DOD QSM 5.3)

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: XD23008

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | VRTB-S-M5_04192022 | Aqueous | 04/19/2022 1025 | 04/23/2022 |
| 002 | VRTB-S-P8_04192022 | Aqueous | 04/19/2022 1155 | 04/23/2022 |
| 003 | VRTB-S-R7_04192022 | Aqueous | 04/19/2022 1355 | 04/23/2022 |
| 004 | VRTB-S-G4_04192022 | Aqueous | 04/19/2022 1450 | 04/23/2022 |

(4 samples)

# Detection Summary

## Arcadis U.S., Inc.

Lot Number: XD23008

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | VRTB-S-M5_04192022 | Aqueous | TOC | SM 5310C- | 130 | | mg/L | 5 |
| 001 | VRTB-S-M5_04192022 | Aqueous | 8:2 FTS | PFAS by ID | 6.5 | J | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | 6:2 FTS | PFAS by ID | 13 | | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | PFBS | PFAS by ID | 3.6 | | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | PFHpS | PFAS by ID | 12 | | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | PFPeS | PFAS by ID | 5.8 | | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | PFHxS | PFAS by ID | 210 | | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | PFBA | PFAS by ID | 14 | | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | PFHpA | PFAS by ID | 19 | | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | PFHxA | PFAS by ID | 29 | | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | PFNA | PFAS by ID | 6.4 | | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | PFOA | PFAS by ID | 22 | | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | PFPeA | PFAS by ID | 25 | | ng/L | 6 |
| 001 | VRTB-S-M5_04192022 | Aqueous | PFOS | PFAS by ID | 1300 | | ng/L | 6 |
| 002 | VRTB-S-P8_04192022 | Aqueous | TOC | SM 5310C- | 14 | | mg/L | 8 |
| 002 | VRTB-S-P8_04192022 | Aqueous | 8:2 FTS | PFAS by ID | 2.1 | J | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | 6:2 FTS | PFAS by ID | 5.3 | J | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | PFBS | PFAS by ID | 4.7 | | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | PFHpS | PFAS by ID | 24 | | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | PFPeS | PFAS by ID | 5.4 | | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | PFHxS | PFAS by ID | 260 | | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | PFBA | PFAS by ID | 8.2 | | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | PFHpA | PFAS by ID | 8.0 | | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | PFHxA | PFAS by ID | 14 | | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | PFNA | PFAS by ID | 9.6 | | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | PFOA | PFAS by ID | 18 | | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | PFPeA | PFAS by ID | 8.3 | | ng/L | 9 |
| 002 | VRTB-S-P8_04192022 | Aqueous | PFOS | PFAS by ID | 5400 | | ng/L | 9 |
| 003 | VRTB-S-R7_04192022 | Aqueous | TOC | SM 5310C- | 110 | | mg/L | 11 |
| 003 | VRTB-S-R7_04192022 | Aqueous | PFHxS | PFAS by ID | 1900 | | ng/L | 12 |
| 003 | VRTB-S-R7_04192022 | Aqueous | PFHxA | PFAS by ID | 210 | J | ng/L | 12 |
| 003 | VRTB-S-R7_04192022 | Aqueous | PFOA | PFAS by ID | 270 | J | ng/L | 12 |
| 003 | VRTB-S-R7_04192022 | Aqueous | PFOS | PFAS by ID | 22000 | | ng/L | 12 |
| 004 | VRTB-S-G4_04192022 | Aqueous | TOC | SM 5310C- | 3.1 | | mg/L | 14 |

(34 detections)

# Inorganic non-metals

Client: Arcadis U.S., Inc.
Laboratory ID: XD23008-001
Description: VRTB-S-M5_04192022
Matrix: Aqueous
Date Sampled: 04/19/2022 1025
Project Name: ESTCP Vertebrae
Date Received: 04/23/2022
Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 2 | | (TOC) SM 5310C-2014 | 2 | 05/09/2022 2100 | DMA | | 40968 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| TOC | | SM 5310C-2014 | 130 | | 4.0 | 3.0 | 1.2 | mg/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD23008-001
Description: VRTB-S-M5_04192022 | Matrix: Aqueous
Date Sampled: 04/19/2022 1025 | Project Name: ESTCP Vertebrae
Date Received: 04/23/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/03/2022 1545 | MMM | 04/26/2022 1146 | 39392 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 05/04/2022 1139 | MMM | 04/26/2022 1146 | 39392 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 6.5 | J | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 13 | | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 3.6 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 12 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 5.8 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 210 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 14 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 19 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 29 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 6.4 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 22 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 25 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1300 | | 35 | 18 | 8.8 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 | | 117 | 50-150 |
| 13C2_6:2FTS | | 142 | 50-150 | | 117 | 50-150 |
| 13C2_8:2FTS | | 96 | 50-150 | | 88 | 50-150 |
| 13C2_PFDoA | | 92 | 50-150 | | 101 | 50-150 |
| 13C2_PFTeDA | | 76 | 50-150 | | 79 | 50-150 |
| 13C3_PFBS | | 104 | 50-150 | | 102 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 | | 106 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 | | 104 | 50-150 |
| 13C4_PFHpA | | 102 | 50-150 | | 108 | 50-150 |
| 13C5_PFHxA | | 110 | 50-150 | | 91 | 50-150 |
| 13C5_PFPeA | | 107 | 50-150 | | 96 | 50-150 |
| 13C6_PFDA | | 104 | 50-150 | | 102 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 | | 96 | 50-150 |
| 13C8_PFOA | | 115 | 50-150 | | 101 | 50-150 |
| 13C8_PFOS | | 84 | 50-150 | | 93 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 | | 107 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD23008-001
Description: VRTB-S-M5_04192022
Matrix: Aqueous
Date Sampled: 04/19/2022 1025
Project Name: ESTCP Vertebrae
Date Received: 04/23/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 82 | 50-150 | | 90 | 50-150 |
| d5-EtFOSAA | | 91 | 50-150 | | 104 | 50-150 |
| d-MeFOSA | | 86 | 50-150 | | 89 | 50-150 |
| d3-MeFOSAA | | 99 | 50-150 | | 97 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# Inorganic non-metals

Client: Arcadis U.S., Inc. | Laboratory ID: XD23008-002
Description: VRTB-S-P8_04192022 | Matrix: Aqueous
Date Sampled: 04/19/2022 1155 | Project Name: ESTCP Vertebrae
Date Received: 04/23/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 2 | | (TOC) SM 5310C-2014 | 1 | 05/09/2022 2113 | DMA | | 40968 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| TOC | | SM 5310C-2014 | 14 | | 2.0 | 1.5 | 0.60 | mg/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD23008-002
Description: VRTB-S-P8_04192022 | Matrix: Aqueous
Date Sampled: 04/19/2022 1155 | Project Name: ESTCP Vertebrae
Date Received: 04/23/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 05/03/2022 1556 | MMM | 04/26/2022 1146 | 39392 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 50 | 05/04/2022 1149 | MMM | 04/26/2022 1146 | 39392 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 2.1 | J | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 5.3 | J | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.7 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 24 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 5.4 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 260 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 8.2 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 8.0 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 14 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 9.6 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 8.3 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 5400 | | 180 | 90 | 44 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 128 | 50-150 | | 110 | 50-150 |
| 13C2_6:2FTS | | 146 | 50-150 | | 99 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 | | 109 | 50-150 |
| 13C2_PFDoA | | 97 | 50-150 | | 95 | 50-150 |
| 13C2_PFTeDA | | 88 | 50-150 | | 87 | 50-150 |
| 13C3_PFBS | | 103 | 50-150 | | 103 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 | | 98 | 50-150 |
| 13C4_PFBA | | 75 | 50-150 | | 102 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 | | 107 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 | | 90 | 50-150 |
| 13C5_PFPeA | | 104 | 50-150 | | 91 | 50-150 |
| 13C6_PFDA | | 109 | 50-150 | | 110 | 50-150 |
| 13C7_PFUdA | | 96 | 50-150 | | 92 | 50-150 |
| 13C8_PFOA | | 105 | 50-150 | | 95 | 50-150 |
| 13C8_PFOS | | 62 | 50-150 | | 98 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 | | 101 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XD23008-002
Description: VRTB-S-P8_04192022
Matrix: Aqueous
Date Sampled: 04/19/2022 1155
Project Name: ESTCP Vertebrae
Date Received: 04/23/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 64 | 50-150 | | 87 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 | | 102 | 50-150 |
| d-MeFOSA | | 103 | 50-150 | | 102 | 50-150 |
| d3-MeFOSAA | | 101 | 50-150 | | 104 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# Inorganic non-metals

Client: Arcadis U.S., Inc.
Laboratory ID: XD23008-003
Description: VRTB-S-R7_04192022
Matrix: Aqueous
Date Sampled: 04/19/2022 1355
Project Name: ESTCP Vertebrae
Date Received: 04/23/2022
Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 2 | | (TOC) SM 5310C-2014 | 2 | 05/09/2022 2126 | DMA | | 40968 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| TOC | | SM 5310C-2014 | 110 | | 4.0 | 3.0 | 1.2 | mg/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XD23008-003
Description: VRTB-S-R7_04192022 | Matrix: Aqueous
Date Sampled: 04/19/2022 1355 | Project Name: ESTCP Vertebrae
Date Received: 04/23/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 200 | 05/02/2022 2210 | NK1 | 04/27/2022 1147 | 39495 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 700 | U | 1400 | 700 | 360 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 700 | U | 1400 | 700 | 360 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 700 | U | 1400 | 700 | 360 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 700 | U | 1400 | 700 | 360 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1500 | U | 2900 | 1500 | 720 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 700 | U | 1400 | 700 | 360 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1900 | | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 210 | J | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 270 | J | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 360 | U | 720 | 360 | 180 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 22000 | | 720 | 360 | 180 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 106 | 50-150 |
| 13C2_6:2FTS | | 118 | 50-150 |
| 13C2_8:2FTS | | 101 | 50-150 |
| 13C2_PFDoA | | 108 | 50-150 |
| 13C2_PFTeDA | | 108 | 50-150 |
| 13C3_PFBS | | 102 | 50-150 |
| 13C3_PFHxS | | 99 | 50-150 |
| 13C4_PFBA | | 105 | 50-150 |
| 13C4_PFHpA | | 110 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 103 | 50-150 |
| 13C6_PFDA | | 103 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 106 | 50-150 |
| 13C8_PFOS | | 100 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 |
| 13C9_PFNA | | 105 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XD23008-003 |
| Description: VRTB-S-R7_04192022 | | | Matrix: Aqueous |
| Date Sampled: 04/19/2022 1355 | | Project Name: ESTCP Vertebrae | |
| Date Received: 04/23/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 107 | 50-150 |
| d-MeFOSA | | 99 | 50-150 |
| d3-MeFOSAA | | 86 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# Inorganic non-metals

Client: Arcadis U.S., Inc.
Laboratory ID: XD23008-004
Description: VRTB-S-G4_04192022
Matrix: Aqueous
Date Sampled: 04/19/2022 1450
Project Name: ESTCP Vertebrae
Date Received: 04/23/2022
Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 2 | | (TOC) SM 5310C-2014 | 1 | 05/09/2022 2139 | DMA | | 40968 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| TOC | | SM 5310C-2014 | 3.1 | | 2.0 | 1.5 | 0.60 | mg/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# Inorganic non-metals - MB

Sample ID: XQ40968-001
Batch: 40968
Analytical Method: SM 5310C-2014

Matrix: Aqueous

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| TOC | 1.5 | U | 1 | 2.0 | 1.5 | 0.60 | mg/L | 05/09/2022 2022 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# Inorganic non-metals - LCS

Sample ID: XQ40968-002
Batch: 40968
Analytical Method: SM 5310C-2014
Matrix: Aqueous

| Parameter | Spike Amount (mg/L) | Result (mg/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| TOC | 20 | 19 | | 1 | 93 | 90-110 | 05/09/2022 2034 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Sample ID: XD23008-004MS
Batch: 40968
Analytical Method: SM 5310C-2014
Matrix: Aqueous

| Parameter | Sample Amount (mg/L) | Spike Amount (mg/L) | Result (mg/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| TOC | 3.1 | 50 | 46 | | 1 | 86 | 70-130 | 05/09/2022 2153 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# Inorganic non-metals - MSD

Sample ID: XD23008-004MD
Batch: 40968
Analytical Method: SM 5310C-2014
Matrix: Aqueous

| Parameter | Sample Amount (mg/L) | Spike Amount (mg/L) | Result (mg/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| TOC | 3.1 | 50 | 45 | | 1 | 83 | 2.6 | 70-130 | 20 | 05/09/2022 2206 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MB

Sample ID: XQ39392-001
Batch: 39392
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/26/2022 1146

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1410 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1410 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1410 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1410 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 05/03/2022 1410 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 05/03/2022 1410 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 05/03/2022 1410 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 108 | 50-150 |
| 13C2_6:2FTS | | 148 | 50-150 |
| 13C2_8:2FTS | | 100 | 50-150 |
| 13C2_PFDoA | | 96 | 50-150 |
| 13C2_PFTeDA | | 85 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 |
| 13C4_PFBA | | 99 | 50-150 |
| 13C4_PFHpA | | 100 | 50-150 |
| 13C5_PFHxA | | 109 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 106 | 50-150 |
| 13C7_PFUdA | | 92 | 50-150 |
| 13C8_PFOA | | 115 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ39392-001
Batch: 39392
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/26/2022 1146

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 |
| 13C9_PFNA | | 91 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 |
| d-MeFOSA | | 89 | 50-150 |
| d3-MeFOSAA | | 101 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ39392-002
Batch: 39392
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/26/2022 1146

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 15 | | 1 | 98 | 67-138 | 05/03/2022 1421 |
| 6:2 FTS | 15 | 19 | | 1 | 126 | 64-140 | 05/03/2022 1421 |
| 4:2 FTS | 15 | 15 | | 1 | 98 | 63-143 | 05/03/2022 1421 |
| EtFOSAA | 16 | 17 | | 1 | 105 | 61-135 | 05/03/2022 1421 |
| MeFOSA | 16 | 15 | | 1 | 93 | 68-141 | 05/03/2022 1421 |
| MeFOSAA | 16 | 16 | | 1 | 100 | 65-136 | 05/03/2022 1421 |
| PFBS | 14 | 15 | | 1 | 104 | 72-130 | 05/03/2022 1421 |
| PFDS | 15 | 15 | | 1 | 100 | 53-142 | 05/03/2022 1421 |
| PFHpS | 15 | 17 | | 1 | 111 | 69-134 | 05/03/2022 1421 |
| PFNS | 15 | 14 | | 1 | 94 | 69-127 | 05/03/2022 1421 |
| PFOSA | 16 | 16 | | 1 | 102 | 67-137 | 05/03/2022 1421 |
| PFPeS | 15 | 15 | | 1 | 103 | 71-127 | 05/03/2022 1421 |
| PFHxS | 15 | 15 | | 1 | 100 | 68-131 | 05/03/2022 1421 |
| PFBA | 16 | 17 | | 1 | 104 | 73-129 | 05/03/2022 1421 |
| PFDA | 16 | 20 | | 1 | 126 | 71-129 | 05/03/2022 1421 |
| PFDoA | 16 | 15 | | 1 | 95 | 72-134 | 05/03/2022 1421 |
| PFHpA | 16 | 17 | | 1 | 104 | 72-130 | 05/03/2022 1421 |
| PFHxA | 16 | 16 | | 1 | 98 | 72-129 | 05/03/2022 1421 |
| PFNA | 16 | 16 | | 1 | 99 | 69-130 | 05/03/2022 1421 |
| PFOA | 16 | 15 | | 1 | 97 | 71-133 | 05/03/2022 1421 |
| PFPeA | 16 | 16 | | 1 | 102 | 72-129 | 05/03/2022 1421 |
| PFTeDA | 16 | 16 | | 1 | 102 | 71-132 | 05/03/2022 1421 |
| PFTrDA | 16 | 15 | | 1 | 91 | 65-144 | 05/03/2022 1421 |
| PFUdA | 16 | 16 | | 1 | 98 | 69-133 | 05/03/2022 1421 |
| PFOS | 15 | 16 | | 1 | 107 | 65-140 | 05/03/2022 1421 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 106 | 50-150 |
| 13C2_6:2FTS | | 115 | 50-150 |
| 13C2_8:2FTS | | 97 | 50-150 |
| 13C2_PFDoA | | 105 | 50-150 |
| 13C2_PFTeDA | | 82 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 102 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 |
| 13C5_PFPeA | | 103 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 98 | 50-150 |
| 13C8_PFOA | | 107 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ39392-002
Batch: 39392
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/26/2022 1146

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 94 | 50-150 |
| 13C8_PFOSA | | 99 | 50-150 |
| 13C9_PFNA | | 96 | 50-150 |
| d5-EtFOSAA | | 88 | 50-150 |
| d-MeFOSA | | 63 | 50-150 |
| d3-MeFOSAA | | 97 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: XD23008-002DU
Batch: 39392
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/26/2022 1146

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 2.1 | 1.8 | J | 1 | 16 | 20 | 05/03/2022 1607 |
| 6:2 FTS | 5.3 | 4.2 | + | 1 | 23 | 20 | 05/03/2022 1607 |
| 4:2 FTS | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| EtFOSAA | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| MeFOSA | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| MeFOSAA | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| PFBS | 4.7 | 5.5 | | 1 | 15 | 20 | 05/03/2022 1607 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| PFHpS | 24 | 25 | | 1 | 4.8 | 20 | 05/03/2022 1607 |
| PFNS | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| PFOSA | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| PFPeS | 5.4 | 5.5 | | 1 | 2.4 | 20 | 05/03/2022 1607 |
| PFHxS | 260 | 250 | | 1 | 2.2 | 20 | 05/03/2022 1607 |
| PFBA | 8.2 | 8.1 | | 1 | 1.4 | 20 | 05/03/2022 1607 |
| PFDA | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| PFHpA | 8.0 | 9.4 | | 1 | 16 | 20 | 05/03/2022 1607 |
| PFHxA | 14 | 14 | | 1 | 2.3 | 20 | 05/03/2022 1607 |
| PFNA | 9.6 | 9.6 | | 1 | 0.79 | 20 | 05/03/2022 1607 |
| PFOA | 18 | 18 | | 1 | 0.13 | 20 | 05/03/2022 1607 |
| PFPeA | 8.3 | 8.8 | | 1 | 5.2 | 20 | 05/03/2022 1607 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| PFUdA | ND | ND | | 1 | 0.00 | 20 | 05/03/2022 1607 |
| PFOS | 6000 | 6300 | E | 1 | 4.5 | 20 | 05/03/2022 1607 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 120 | 50-150 |
| 13C2_6:2FTS | | 146 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 |
| 13C2_PFDoA | | 100 | 50-150 |
| 13C2_PFTeDA | | 88 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 |
| 13C3_PFHxS | | 90 | 50-150 |
| 13C4_PFBA | | 82 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 101 | 50-150 |
| 13C6_PFDA | | 104 | 50-150 |
| 13C7_PFUdA | | 98 | 50-150 |
| 13C8_PFOA | | 104 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: XD23008-002DU
Batch: 39392
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/26/2022 1146

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 59 | 50-150 |
| 13C8_PFOSA | | 104 | 50-150 |
| 13C9_PFNA | | 64 | 50-150 |
| d5-EtFOSAA | | 90 | 50-150 |
| d-MeFOSA | | 107 | 50-150 |
| d3-MeFOSAA | | 96 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ39495-001
Batch: 39495
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/27/2022 1147

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2113 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2113 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2113 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2113 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 04/27/2022 2113 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 04/27/2022 2113 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 04/27/2022 2113 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 57 | 50-150 |
| 13C2_6:2FTS | | 55 | 50-150 |
| 13C2_8:2FTS | | 55 | 50-150 |
| 13C2_PFDoA | | 53 | 50-150 |
| 13C2_PFTeDA | | 53 | 50-150 |
| 13C3_PFBS | | 56 | 50-150 |
| 13C3_PFHxS | | 58 | 50-150 |
| 13C4_PFBA | | 54 | 50-150 |
| 13C4_PFHpA | | 56 | 50-150 |
| 13C5_PFHxA | | 57 | 50-150 |
| 13C5_PFPeA | | 56 | 50-150 |
| 13C6_PFDA | | 53 | 50-150 |
| 13C7_PFUdA | | 55 | 50-150 |
| 13C8_PFOA | | 58 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ39495-001
Batch: 39495
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/27/2022 1147

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 56 | 50-150 |
| 13C8_PFOSA | | 56 | 50-150 |
| 13C9_PFNA | | 54 | 50-150 |
| d5-EtFOSAA | | 55 | 50-150 |
| d-MeFOSA | N | 47 | 50-150 |
| d3-MeFOSAA | | 55 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ39495-002
Batch: 39495
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/27/2022 1147

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 18 | | 1 | 116 | 67-138 | 04/27/2022 2124 |
| 6:2 FTS | 15 | 17 | | 1 | 113 | 64-140 | 04/27/2022 2124 |
| 4:2 FTS | 15 | 19 | | 1 | 124 | 63-143 | 04/27/2022 2124 |
| EtFOSAA | 16 | 18 | | 1 | 111 | 61-135 | 04/27/2022 2124 |
| MeFOSA | 16 | 17 | | 1 | 109 | 68-141 | 04/27/2022 2124 |
| MeFOSAA | 16 | 17 | | 1 | 107 | 65-136 | 04/27/2022 2124 |
| PFBS | 14 | 16 | | 1 | 115 | 72-130 | 04/27/2022 2124 |
| PFDS | 15 | 16 | | 1 | 101 | 53-142 | 04/27/2022 2124 |
| PFHpS | 15 | 18 | | 1 | 115 | 69-134 | 04/27/2022 2124 |
| PFNS | 15 | 17 | | 1 | 111 | 69-127 | 04/27/2022 2124 |
| PFOSA | 16 | 17 | | 1 | 106 | 67-137 | 04/27/2022 2124 |
| PFPeS | 15 | 17 | | 1 | 116 | 71-127 | 04/27/2022 2124 |
| PFHxS | 15 | 16 | | 1 | 112 | 68-131 | 04/27/2022 2124 |
| PFBA | 16 | 18 | | 1 | 112 | 73-129 | 04/27/2022 2124 |
| PFDA | 16 | 18 | | 1 | 110 | 71-129 | 04/27/2022 2124 |
| PFDoA | 16 | 18 | | 1 | 114 | 72-134 | 04/27/2022 2124 |
| PFHpA | 16 | 19 | | 1 | 117 | 72-130 | 04/27/2022 2124 |
| PFHxA | 16 | 18 | | 1 | 110 | 72-129 | 04/27/2022 2124 |
| PFNA | 16 | 17 | | 1 | 108 | 69-130 | 04/27/2022 2124 |
| PFOA | 16 | 18 | | 1 | 114 | 71-133 | 04/27/2022 2124 |
| PFPeA | 16 | 18 | | 1 | 114 | 72-129 | 04/27/2022 2124 |
| PFTeDA | 16 | 18 | | 1 | 115 | 71-132 | 04/27/2022 2124 |
| PFTrDA | 16 | 17 | | 1 | 106 | 65-144 | 04/27/2022 2124 |
| PFUdA | 16 | 18 | | 1 | 114 | 69-133 | 04/27/2022 2124 |
| PFOS | 15 | 16 | | 1 | 108 | 65-140 | 04/27/2022 2124 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 138 | 50-150 |
| 13C2_6:2FTS | | 134 | 50-150 |
| 13C2_8:2FTS | | 143 | 50-150 |
| 13C2_PFDoA | | 137 | 50-150 |
| 13C2_PFTeDA | | 133 | 50-150 |
| 13C3_PFBS | | 148 | 50-150 |
| 13C3_PFHxS | | 147 | 50-150 |
| 13C4_PFBA | | 142 | 50-150 |
| 13C4_PFHpA | | 142 | 50-150 |
| 13C5_PFHxA | N | 152 | 50-150 |
| 13C5_PFPeA | | 142 | 50-150 |
| 13C6_PFDA | | 141 | 50-150 |
| 13C7_PFUdA | | 139 | 50-150 |
| 13C8_PFOA | N | 152 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ39495-002
Batch: 39495
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 04/27/2022 1147

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 149 | 50-150 |
| 13C8_PFOSA | | 136 | 50-150 |
| 13C9_PFNA | | 143 | 50-150 |
| d5-EtFOSAA | | 141 | 50-150 |
| d-MeFOSA | | 132 | 50-150 |
| d3-MeFOSAA | | 147 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical Services, LLC (formerly Shealy Environmental Services, Inc.)
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com



Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 111172

Client: Arcadis
Report to Contact: Kristen Hasbrouck, Craig Divine, and Jesse Wright
Telephone No. / E-mail: Kristen.Hasbrouck@arcadis.com; Craig.Divine@arcadis.com; Jesse.Wright@arcadis.com
Quote No.:
Address: 28550 Cabot Drive, Suite 500
Sampler's Signature: x Austin Westhuis
City: Novi | State: MI | Zip Code: 48377
Printed Name: Austin Westhuis
Project Name: ESTCP Vertebrae - Grayling, MI
Project No.: 30027244.00003
P.O. No.:
Page 1 of 1

XD23008

KE32

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab (G) / Composite (C) | Matrix: Aqueous | Soils | Air / Waste | No. of Containers by Preservative Type: Unpres. | HCl | HNO3 | H2SO4 | NaOH | Na2S2O3 | Field Filtered | PFAS per USEPA Method 537.1 or Isotope dilution for DoD QSM 5.3 | Total Organic Carbon | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-S-MS_04192022 | 4/19/22 | 1025 | G | X | | | 3 | | | | | | | X | X | * TOC not field preserved and needs to be lab preserved |
| VRTB-S-PB_04192022 | 4/19/22 | 1155 | G | X | | | 3 | | | | | | | X | X | |
| VRTB-S-R7_04192022 | 4/19/22 | 1355 | G | X | | | 3 | | | | | | | X | X | |
| VRTB-S-G4_04192022 | 4/19/22 | 1450 | G | X | | | 1 | | | | | | | | X | |

Turn Around Time Required (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify)
Sample Disposal: ☐ Return to Client X Disposal by Lab
Possible Hazard Identification: X Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown
QC Requirements (Specify)

| | Date | Time |
|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | 4/22/22 | 1045 |
| 2. Relinquished by | | |
| 3. Relinquished by | | |
| 4. Relinquished by: FedEx | 4-23-22 | 0940 |

| | Date | Time |
|---|---|---|
| 1. Received by: FedEx | 4/22/22 | 1045 |
| 2. Received by | | |
| 3. Received by | | |
| 4. Laboratory Received by | 4/23-22 | 0940 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle): Yes No Ice Pack
Receipt Temp: 3.4 °C
Temp Blank ☐ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

# Sample Receipt Checklist (SRC)

Client: aquadis

Cooler Inspected by/date: TEC / 04/23/2022 Lot #: XD23008

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☐ Yes | ☑ No | | 1. Were custody seals present on the cooler? |
| ☐ Yes | ☐ No | ☑ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: NA

3.9 / 3.9 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☐ Yes | ☐ No | ☑ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☐ Yes | ☐ No | ☑ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☑ Yes | ☐ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS? |
| ☐ Yes | ☑ No | | 21. Was the quote number listed on the container label? If yes, Quote # |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA. Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no* ) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: TEC Date: 04/23/2022

Comments:

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

# Sample Receipt Checklist (SRC)

Client: arcadis

Cooler Inspected by/date: TEC / 04/23/2022 Lot #: XD23008

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☐ Yes | ☑ No | | 1. Were custody seals present on the cooler? |
| ☐ Yes | ☐ No | ☑ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: NA

3.9 / 3.9 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☐ Yes | ☐ No | ☑ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☐ Yes | ☐ No | ☑ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☑ Yes | ☐ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc...) correctly transcribed from the COC into the comment section in LIMS? |
| ☐ Yes | ☑ No | | 21. Was the quote number listed on the container label? If yes, Quote # |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA 001, 002, 005 were received incorrectly preserved and were adjusted accordingly in sample receiving with NA 2.5mL of circle one: (H2SO4) HNO3, HCl, NaOH using SR # NA 0-3-001.

Time of preservation NA 1100. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L. (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: TEC Date: 04/23/2022

Comments:

# Performance Monitoring Event #3

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

Lot Number:**XF17015**

Date Completed:07/19/2022

07/19/2022 6:38 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: XF17015

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples were compliant with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC

Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

For samples XF17015-010, XF17015-015, XF17015-016, XF17015-017, and XF17015-018, sample matrix prevented full volume from being extracted, precluding method mandated bottle rinse. Elution solvent was aliquoted directly into the reservoir, rinsing the inside. Surrogate recovery may be adversely affected.

Surrogate recovery for the following samples was outside control limits: XF17015-010, XF17015-013, XF17015-017, XF17015-018. Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Surrogate recovery for the following sample was outside the upper control limit: XF17015-019. This sample did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

The MS/MSD associated with sample XF17015-020 had compounds recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

The method blank associated with batch 46282 had PFBA detected at a concentration that was above the MDL but below ½ the PQL. All samples associated with this method blank that have detections for PFBA have been flagged with a "B".

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: XF17015

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | VRTB-D-M5_6132022 | Aqueous | 06/13/2022 1240 | 06/17/2022 |
| 002 | VRTB-D-06_6132022 | Aqueous | 06/13/2022 1350 | 06/17/2022 |
| 003 | VRTB-D-R7_6132022 | Aqueous | 06/13/2022 1510 | 06/17/2022 |
| 004 | VRTB-D-P8_6132022 | Aqueous | 06/13/2022 1615 | 06/17/2022 |
| 005 | Dup-01_06132022 | Aqueous | 06/13/2022 | 06/17/2022 |
| 006 | VRTB-S-B1_6132022 | Aqueous | 06/13/2022 1730 | 06/17/2022 |
| 007 | VRTB-S-S2_6132022 | Aqueous | 06/13/2022 1825 | 06/17/2022 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | 06/13/2022 1905 | 06/17/2022 |
| 009 | VRTB-S-G4_6132022 | Aqueous | 06/13/2022 1945 | 06/17/2022 |
| 010 | VRTB-L-B1_6142022 | Aqueous | 06/14/2022 0910 | 06/17/2022 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | 06/14/2022 1630 | 06/17/2022 |
| 012 | VRTB-L-P7_6142022 | Aqueous | 06/14/2022 1545 | 06/17/2022 |
| 013 | VRTB-L-06_6142022 | Aqueous | 06/14/2022 1435 | 06/17/2022 |
| 014 | VRTB-L-M5_6142022 | Aqueous | 06/14/2022 1340 | 06/17/2022 |
| 015 | VRTB-L-G4_6142022 | Aqueous | 06/14/2022 1205 | 06/17/2022 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | 06/14/2022 1115 | 06/17/2022 |
| 017 | VRTB-L-S2_6142022 | Aqueous | 06/14/2022 1025 | 06/17/2022 |
| 018 | Dup-02_06142022 | Aqueous | 06/14/2022 | 06/17/2022 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | 06/14/2022 1740 | 06/17/2022 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | 06/14/2022 1815 | 06/17/2022 |

(20 samples)

# Detection Summary

## Arcadis U.S., Inc.

Lot Number: XF17015

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | VRTB-D-M5_6132022 | Aqueous | PFBS | PFAS by ID | 3.5 | | ng/L | 11 |
| 001 | VRTB-D-M5_6132022 | Aqueous | PFHpS | PFAS by ID | 3.1 | J | ng/L | 11 |
| 001 | VRTB-D-M5_6132022 | Aqueous | PFPeS | PFAS by ID | 3.9 | | ng/L | 11 |
| 001 | VRTB-D-M5_6132022 | Aqueous | PFHxS | PFAS by ID | 67 | | ng/L | 11 |
| 001 | VRTB-D-M5_6132022 | Aqueous | PFBA | PFAS by ID | 6.7 | | ng/L | 11 |
| 001 | VRTB-D-M5_6132022 | Aqueous | PFHpA | PFAS by ID | 4.4 | | ng/L | 11 |
| 001 | VRTB-D-M5_6132022 | Aqueous | PFHxA | PFAS by ID | 9.3 | | ng/L | 11 |
| 001 | VRTB-D-M5_6132022 | Aqueous | PFOA | PFAS by ID | 4.0 | | ng/L | 11 |
| 001 | VRTB-D-M5_6132022 | Aqueous | PFPeA | PFAS by ID | 13 | | ng/L | 11 |
| 001 | VRTB-D-M5_6132022 | Aqueous | PFOS | PFAS by ID | 260 | | ng/L | 11 |
| 002 | VRTB-D-06_6132022 | Aqueous | PFBS | PFAS by ID | 2.6 | J | ng/L | 13 |
| 002 | VRTB-D-06_6132022 | Aqueous | PFHpS | PFAS by ID | 5.2 | | ng/L | 13 |
| 002 | VRTB-D-06_6132022 | Aqueous | PFPeS | PFAS by ID | 4.8 | | ng/L | 13 |
| 002 | VRTB-D-06_6132022 | Aqueous | PFHxS | PFAS by ID | 75 | | ng/L | 13 |
| 002 | VRTB-D-06_6132022 | Aqueous | PFBA | PFAS by ID | 6.7 | | ng/L | 13 |
| 002 | VRTB-D-06_6132022 | Aqueous | PFHpA | PFAS by ID | 5.1 | | ng/L | 13 |
| 002 | VRTB-D-06_6132022 | Aqueous | PFHxA | PFAS by ID | 9.1 | | ng/L | 13 |
| 002 | VRTB-D-06_6132022 | Aqueous | PFNA | PFAS by ID | 0.97 | J | ng/L | 13 |
| 002 | VRTB-D-06_6132022 | Aqueous | PFOA | PFAS by ID | 6.0 | | ng/L | 13 |
| 002 | VRTB-D-06_6132022 | Aqueous | PFPeA | PFAS by ID | 9.4 | | ng/L | 13 |
| 002 | VRTB-D-06_6132022 | Aqueous | PFOS | PFAS by ID | 230 | | ng/L | 13 |
| 003 | VRTB-D-R7_6132022 | Aqueous | PFBS | PFAS by ID | 2.2 | J | ng/L | 15 |
| 003 | VRTB-D-R7_6132022 | Aqueous | PFHpS | PFAS by ID | 1.1 | J | ng/L | 15 |
| 003 | VRTB-D-R7_6132022 | Aqueous | PFPeS | PFAS by ID | 1.6 | J | ng/L | 15 |
| 003 | VRTB-D-R7_6132022 | Aqueous | PFHxS | PFAS by ID | 49 | | ng/L | 15 |
| 003 | VRTB-D-R7_6132022 | Aqueous | PFBA | PFAS by ID | 11 | | ng/L | 15 |
| 003 | VRTB-D-R7_6132022 | Aqueous | PFHpA | PFAS by ID | 12 | | ng/L | 15 |
| 003 | VRTB-D-R7_6132022 | Aqueous | PFHxA | PFAS by ID | 12 | | ng/L | 15 |
| 003 | VRTB-D-R7_6132022 | Aqueous | PFNA | PFAS by ID | 1.1 | J | ng/L | 15 |
| 003 | VRTB-D-R7_6132022 | Aqueous | PFOA | PFAS by ID | 6.4 | | ng/L | 15 |
| 003 | VRTB-D-R7_6132022 | Aqueous | PFPeA | PFAS by ID | 19 | | ng/L | 15 |
| 003 | VRTB-D-R7_6132022 | Aqueous | PFOS | PFAS by ID | 92 | | ng/L | 15 |
| 004 | VRTB-D-P8_6132022 | Aqueous | PFBS | PFAS by ID | 4.0 | | ng/L | 17 |
| 004 | VRTB-D-P8_6132022 | Aqueous | PFHpS | PFAS by ID | 2.4 | J | ng/L | 17 |
| 004 | VRTB-D-P8_6132022 | Aqueous | PFPeS | PFAS by ID | 2.5 | J | ng/L | 17 |
| 004 | VRTB-D-P8_6132022 | Aqueous | PFHxS | PFAS by ID | 75 | | ng/L | 17 |
| 004 | VRTB-D-P8_6132022 | Aqueous | PFBA | PFAS by ID | 13 | | ng/L | 17 |
| 004 | VRTB-D-P8_6132022 | Aqueous | PFHpA | PFAS by ID | 24 | | ng/L | 17 |
| 004 | VRTB-D-P8_6132022 | Aqueous | PFHxA | PFAS by ID | 21 | | ng/L | 17 |
| 004 | VRTB-D-P8_6132022 | Aqueous | PFNA | PFAS by ID | 4.2 | | ng/L | 17 |
| 004 | VRTB-D-P8_6132022 | Aqueous | PFOA | PFAS by ID | 18 | | ng/L | 17 |
| 004 | VRTB-D-P8_6132022 | Aqueous | PFPeA | PFAS by ID | 25 | | ng/L | 17 |
| 004 | VRTB-D-P8_6132022 | Aqueous | PFOS | PFAS by ID | 150 | | ng/L | 17 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 005 | Dup-01_06132022 | Aqueous | PFBS | PFAS by ID | 4.2 | | ng/L | 19 |
| 005 | Dup-01_06132022 | Aqueous | PFHpS | PFAS by ID | 2.4 | J | ng/L | 19 |
| 005 | Dup-01_06132022 | Aqueous | PFPeS | PFAS by ID | 2.5 | J | ng/L | 19 |
| 005 | Dup-01_06132022 | Aqueous | PFHxS | PFAS by ID | 78 | | ng/L | 19 |
| 005 | Dup-01_06132022 | Aqueous | PFBA | PFAS by ID | 13 | | ng/L | 19 |
| 005 | Dup-01_06132022 | Aqueous | PFHpA | PFAS by ID | 24 | | ng/L | 19 |
| 005 | Dup-01_06132022 | Aqueous | PFHxA | PFAS by ID | 22 | | ng/L | 19 |
| 005 | Dup-01_06132022 | Aqueous | PFNA | PFAS by ID | 4.4 | | ng/L | 19 |
| 005 | Dup-01_06132022 | Aqueous | PFOA | PFAS by ID | 18 | | ng/L | 19 |
| 005 | Dup-01_06132022 | Aqueous | PFPeA | PFAS by ID | 26 | | ng/L | 19 |
| 005 | Dup-01_06132022 | Aqueous | PFOS | PFAS by ID | 160 | | ng/L | 19 |
| 006 | VRTB-S-B1_6132022 | Aqueous | PFBS | PFAS by ID | 2.6 | J | ng/L | 21 |
| 006 | VRTB-S-B1_6132022 | Aqueous | PFHpS | PFAS by ID | 0.91 | J | ng/L | 21 |
| 006 | VRTB-S-B1_6132022 | Aqueous | PFPeS | PFAS by ID | 1.9 | J | ng/L | 21 |
| 006 | VRTB-S-B1_6132022 | Aqueous | PFHxS | PFAS by ID | 25 | | ng/L | 21 |
| 006 | VRTB-S-B1_6132022 | Aqueous | PFBA | PFAS by ID | 3.2 | J | ng/L | 21 |
| 006 | VRTB-S-B1_6132022 | Aqueous | PFHpA | PFAS by ID | 1.1 | J | ng/L | 21 |
| 006 | VRTB-S-B1_6132022 | Aqueous | PFHxA | PFAS by ID | 1.7 | J | ng/L | 21 |
| 006 | VRTB-S-B1_6132022 | Aqueous | PFOA | PFAS by ID | 1.7 | J | ng/L | 21 |
| 006 | VRTB-S-B1_6132022 | Aqueous | PFPeA | PFAS by ID | 1.6 | J | ng/L | 21 |
| 006 | VRTB-S-B1_6132022 | Aqueous | PFOS | PFAS by ID | 140 | | ng/L | 21 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFBS | PFAS by ID | 5.8 | | ng/L | 23 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFHpS | PFAS by ID | 6.5 | | ng/L | 23 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFOSA | PFAS by ID | 0.89 | J | ng/L | 23 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFPeS | PFAS by ID | 7.2 | | ng/L | 23 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFHxS | PFAS by ID | 140 | | ng/L | 23 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFBA | PFAS by ID | 7.2 | | ng/L | 23 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFHpA | PFAS by ID | 17 | | ng/L | 23 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFHxA | PFAS by ID | 12 | | ng/L | 23 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFNA | PFAS by ID | 4.9 | | ng/L | 23 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFOA | PFAS by ID | 20 | | ng/L | 23 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFPeA | PFAS by ID | 9.5 | | ng/L | 23 |
| 007 | VRTB-S-S2_6132022 | Aqueous | PFOS | PFAS by ID | 680 | | ng/L | 23 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | 8:2 FTS | PFAS by ID | 2.0 | J | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFBS | PFAS by ID | 5.9 | | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFHpS | PFAS by ID | 19 | | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFOSA | PFAS by ID | 1.1 | J | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFPeS | PFAS by ID | 12 | | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFHxS | PFAS by ID | 320 | | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFBA | PFAS by ID | 8.1 | | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFHpA | PFAS by ID | 9.9 | | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFHxA | PFAS by ID | 20 | | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFNA | PFAS by ID | 4.0 | | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFOA | PFAS by ID | 14 | | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFPeA | PFAS by ID | 12 | | ng/L | 25 |
| 008 | VRTB-S-Y3_6132022 | Aqueous | PFOS | PFAS by ID | 1200 | | ng/L | 25 |
| 009 | VRTB-S-G4_6132022 | Aqueous | PFBS | PFAS by ID | 9.2 | | ng/L | 27 |
| 009 | VRTB-S-G4_6132022 | Aqueous | PFHpS | PFAS by ID | 13 | | ng/L | 27 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 009 | VRTB-S-G4_6132022 | Aqueous | PFPeS | PFAS by ID | 20 | | ng/L | 27 |
| 009 | VRTB-S-G4_6132022 | Aqueous | PFHxS | PFAS by ID | 350 | | ng/L | 27 |
| 009 | VRTB-S-G4_6132022 | Aqueous | PFBA | PFAS by ID | 6.7 | | ng/L | 27 |
| 009 | VRTB-S-G4_6132022 | Aqueous | PFHpA | PFAS by ID | 6.7 | | ng/L | 27 |
| 009 | VRTB-S-G4_6132022 | Aqueous | PFHxA | PFAS by ID | 16 | | ng/L | 27 |
| 009 | VRTB-S-G4_6132022 | Aqueous | PFNA | PFAS by ID | 1.4 | J | ng/L | 27 |
| 009 | VRTB-S-G4_6132022 | Aqueous | PFOA | PFAS by ID | 9.4 | | ng/L | 27 |
| 009 | VRTB-S-G4_6132022 | Aqueous | PFPeA | PFAS by ID | 6.4 | | ng/L | 27 |
| 009 | VRTB-S-G4_6132022 | Aqueous | PFOS | PFAS by ID | 680 | | ng/L | 27 |
| 010 | VRTB-L-B1_6142022 | Aqueous | 8:2 FTS | PFAS by ID | 3.8 | J | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | 6:2 FTS | PFAS by ID | 2.6 | J | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | PFBS | PFAS by ID | 10 | | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | PFHpS | PFAS by ID | 15 | | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | PFPeS | PFAS by ID | 19 | | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | PFHxS | PFAS by ID | 230 | | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | PFBA | PFAS by ID | 10 | | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | PFHpA | PFAS by ID | 14 | | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | PFHxA | PFAS by ID | 23 | | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | PFNA | PFAS by ID | 8.6 | | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | PFOA | PFAS by ID | 39 | | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | PFPeA | PFAS by ID | 17 | | ng/L | 29 |
| 010 | VRTB-L-B1_6142022 | Aqueous | PFOS | PFAS by ID | 1000 | | ng/L | 29 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | 8:2 FTS | PFAS by ID | 10 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | 6:2 FTS | PFAS by ID | 15 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | PFBS | PFAS by ID | 15 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | PFHpS | PFAS by ID | 27 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | PFPeS | PFAS by ID | 25 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | PFHxS | PFAS by ID | 540 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | PFBA | PFAS by ID | 44 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | PFHpA | PFAS by ID | 52 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | PFHxA | PFAS by ID | 100 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | PFNA | PFAS by ID | 24 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | PFOA | PFAS by ID | 54 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | PFPeA | PFAS by ID | 110 | | ng/L | 31 |
| 011 | VRTB-L-BB8_6142022 | Aqueous | PFOS | PFAS by ID | 5800 | | ng/L | 31 |
| 012 | VRTB-L-P7_6142022 | Aqueous | 8:2 FTS | PFAS by ID | 39 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | 6:2 FTS | PFAS by ID | 77 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | PFBS | PFAS by ID | 10 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | PFHpS | PFAS by ID | 65 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | PFPeS | PFAS by ID | 24 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | PFHxS | PFAS by ID | 790 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | PFBA | PFAS by ID | 37 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | PFHpA | PFAS by ID | 92 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | PFHxA | PFAS by ID | 99 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | PFNA | PFAS by ID | 54 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | PFOA | PFAS by ID | 140 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | PFPeA | PFAS by ID | 88 | | ng/L | 33 |
| 012 | VRTB-L-P7_6142022 | Aqueous | PFOS | PFAS by ID | 13000 | | ng/L | 33 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 013 | VRTB-L-06_6142022 | Aqueous | 8:2 FTS | PFAS by ID | 35 | | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | 6:2 FTS | PFAS by ID | 75 | | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | PFBS | PFAS by ID | 8.2 | | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | PFHpS | PFAS by ID | 45 | | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | PFPeS | PFAS by ID | 9.0 | | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | PFHxS | PFAS by ID | 490 | J | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | PFBA | PFAS by ID | 51 | B | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | PFHpA | PFAS by ID | 170 | | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | PFHxA | PFAS by ID | 95 | | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | PFNA | PFAS by ID | 69 | Q | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | PFOA | PFAS by ID | 210 | | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | PFPeA | PFAS by ID | 97 | | ng/L | 35 |
| 013 | VRTB-L-06_6142022 | Aqueous | PFOS | PFAS by ID | 14000 | | ng/L | 35 |
| 014 | VRTB-L-M5_6142022 | Aqueous | 8:2 FTS | PFAS by ID | 30 | | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | 6:2 FTS | PFAS by ID | 56 | | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | PFBS | PFAS by ID | 9.0 | | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | PFHpS | PFAS by ID | 32 | | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | PFPeS | PFAS by ID | 19 | | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | PFHxS | PFAS by ID | 510 | | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | PFBA | PFAS by ID | 36 | B | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | PFHpA | PFAS by ID | 110 | | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | PFHxA | PFAS by ID | 97 | | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | PFNA | PFAS by ID | 44 | | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | PFOA | PFAS by ID | 100 | | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | PFPeA | PFAS by ID | 79 | | ng/L | 37 |
| 014 | VRTB-L-M5_6142022 | Aqueous | PFOS | PFAS by ID | 7100 | | ng/L | 37 |
| 015 | VRTB-L-G4_6142022 | Aqueous | 8:2 FTS | PFAS by ID | 31 | | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | 6:2 FTS | PFAS by ID | 60 | | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | PFBS | PFAS by ID | 15 | | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | PFHpS | PFAS by ID | 36 | | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | PFPeS | PFAS by ID | 45 | | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | PFHxS | PFAS by ID | 1100 | | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | PFBA | PFAS by ID | 53 | B | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | PFHpA | PFAS by ID | 120 | | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | PFHxA | PFAS by ID | 190 | | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | PFNA | PFAS by ID | 18 | | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | PFOA | PFAS by ID | 130 | | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | PFPeA | PFAS by ID | 95 | | ng/L | 39 |
| 015 | VRTB-L-G4_6142022 | Aqueous | PFOS | PFAS by ID | 2100 | | ng/L | 39 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | 8:2 FTS | PFAS by ID | 93 | | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | 6:2 FTS | PFAS by ID | 130 | | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFBS | PFAS by ID | 6.1 | | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFHpS | PFAS by ID | 90 | | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFOSA | PFAS by ID | 1.7 | J | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFPeS | PFAS by ID | 24 | | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFHxS | PFAS by ID | 2300 | | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFBA | PFAS by ID | 53 | B | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFHpA | PFAS by ID | 110 | | ng/L | 41 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFHxA | PFAS by ID | 130 | | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFNA | PFAS by ID | 45 | | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFOA | PFAS by ID | 410 | | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFPeA | PFAS by ID | 72 | | ng/L | 41 |
| 016 | VRTB-L-Y3_6142022 | Aqueous | PFOS | PFAS by ID | 4500 | | ng/L | 41 |
| 017 | VRTB-L-S2_6142022 | Aqueous | 8:2 FTS | PFAS by ID | 38 | | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | 6:2 FTS | PFAS by ID | 80 | | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | PFBS | PFAS by ID | 11 | | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | PFHpS | PFAS by ID | 44 | | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | PFPeS | PFAS by ID | 23 | | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | PFHxS | PFAS by ID | 1100 | | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | PFBA | PFAS by ID | 23 | B | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | PFHpA | PFAS by ID | 49 | | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | PFHxA | PFAS by ID | 62 | | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | PFNA | PFAS by ID | 44 | | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | PFOA | PFAS by ID | 180 | | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | PFPeA | PFAS by ID | 27 | | ng/L | 43 |
| 017 | VRTB-L-S2_6142022 | Aqueous | PFOS | PFAS by ID | 5600 | | ng/L | 43 |
| 018 | Dup-02_06142022 | Aqueous | 8:2 FTS | PFAS by ID | 45 | | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | 6:2 FTS | PFAS by ID | 86 | | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | PFBS | PFAS by ID | 13 | | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | PFHpS | PFAS by ID | 51 | | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | PFPeS | PFAS by ID | 27 | | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | PFHxS | PFAS by ID | 720 | | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | PFBA | PFAS by ID | 27 | B | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | PFHpA | PFAS by ID | 46 | | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | PFHxA | PFAS by ID | 74 | | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | PFNA | PFAS by ID | 50 | | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | PFOA | PFAS by ID | 200 | | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | PFPeA | PFAS by ID | 26 | | ng/L | 45 |
| 018 | Dup-02_06142022 | Aqueous | PFOS | PFAS by ID | 3900 | | ng/L | 45 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | PFBS | PFAS by ID | 19 | | ng/L | 47 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | PFHpS | PFAS by ID | 19 | | ng/L | 47 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | PFPeS | PFAS by ID | 24 | | ng/L | 47 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | PFHxS | PFAS by ID | 350 | | ng/L | 47 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | PFBA | PFAS by ID | 19 | B | ng/L | 47 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | PFHpA | PFAS by ID | 11 | | ng/L | 47 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | PFHxA | PFAS by ID | 28 | | ng/L | 47 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | PFNA | PFAS by ID | 2.4 | J | ng/L | 47 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | PFOA | PFAS by ID | 56 | | ng/L | 47 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | PFPeA | PFAS by ID | 16 | | ng/L | 47 |
| 019 | MW-VRTB-2D_06142022 | Aqueous | PFOS | PFAS by ID | 520 | | ng/L | 47 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | 8:2 FTS | PFAS by ID | 7.6 | | ng/L | 49 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | 6:2 FTS | PFAS by ID | 28 | | ng/L | 49 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | PFBS | PFAS by ID | 11 | | ng/L | 49 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | PFHpS | PFAS by ID | 38 | S | ng/L | 49 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | PFPeS | PFAS by ID | 22 | | ng/L | 49 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | PFHxS | PFAS by ID | 670 | | ng/L | 49 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 020 | MW-VRTB-2S_06142022 | Aqueous | PFBA | PFAS by ID | 33 | B | ng/L | 49 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | PFHpA | PFAS by ID | 64 | | ng/L | 49 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | PFHxA | PFAS by ID | 91 | S | ng/L | 49 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | PFNA | PFAS by ID | 31 | | ng/L | 49 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | PFOA | PFAS by ID | 110 | S | ng/L | 49 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | PFPeA | PFAS by ID | 71 | | ng/L | 49 |
| 020 | MW-VRTB-2S_06142022 | Aqueous | PFOS | PFAS by ID | 6200 | | ng/L | 49 |

(242 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-001
Description: VRTB-D-M5_6132022 | Matrix: Aqueous
Date Sampled: 06/13/2022 1240 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/28/2022 1450 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 3.5 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 3.1 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 3.9 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 67 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.7 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 4.4 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 9.3 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 4.0 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 13 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 260 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 |
| 13C2_6:2FTS | | 107 | 50-150 |
| 13C2_8:2FTS | | 101 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 |
| 13C2_PFTeDA | | 59 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 |
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 96 | 50-150 |
| 13C9_PFNA | | 91 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XF17015-001 |
| Description: VRTB-D-M5_6132022 | | | Matrix: Aqueous |
| Date Sampled: 06/13/2022 1240 | | Project Name: ESTCP Vertebrae | |
| Date Received: 06/17/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 99 | 50-150 |
| d-MeFOSA | | 74 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-002
Description: VRTB-D-06_6132022 | Matrix: Aqueous
Date Sampled: 06/13/2022 1350 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/28/2022 1502 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.6 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 5.2 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 4.8 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 75 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.7 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 5.1 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 9.1 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.97 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 6.0 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 9.4 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 230 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 118 | 50-150 |
| 13C2_6:2FTS | | 117 | 50-150 |
| 13C2_8:2FTS | | 113 | 50-150 |
| 13C2_PFDoA | | 96 | 50-150 |
| 13C2_PFTeDA | | 63 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 |
| 13C4_PFBA | | 90 | 50-150 |
| 13C4_PFHpA | | 101 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 94 | 50-150 |
| 13C7_PFUdA | | 95 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 |
| 13C8_PFOS | | 96 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 |
| 13C9_PFNA | | 96 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XF17015-002 |
| Description: VRTB-D-06_6132022 | | | Matrix: Aqueous |
| Date Sampled: 06/13/2022 1350 | | Project Name: ESTCP Vertebrae | |
| Date Received: 06/17/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 106 | 50-150 |
| d-MeFOSA | | 71 | 50-150 |
| d3-MeFOSAA | | 106 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-003
Description: VRTB-D-R7_6132022 | Matrix: Aqueous
Date Sampled: 06/13/2022 1510 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/28/2022 1515 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.2 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.1 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.6 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 49 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 11 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 12 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 12 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.1 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 6.4 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 19 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 92 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 117 | 50-150 |
| 13C2_6:2FTS | | 112 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 |
| 13C2_PFTeDA | | 54 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 82 | 50-150 |
| 13C4_PFHpA | | 92 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 89 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 |
| 13C8_PFOS | | 97 | 50-150 |
| 13C8_PFOSA | | 93 | 50-150 |
| 13C9_PFNA | | 93 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XF17015-003 |
| Description: VRTB-D-R7_6132022 | | | Matrix: Aqueous |
| Date Sampled: 06/13/2022 1510 | | Project Name: ESTCP Vertebrae | |
| Date Received: 06/17/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 98 | 50-150 |
| d-MeFOSA | | 72 | 50-150 |
| d3-MeFOSAA | | 97 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-004
Description: VRTB-D-P8_6132022 | Matrix: Aqueous
Date Sampled: 06/13/2022 1615 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/28/2022 1528 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.0 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.4 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.5 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 75 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 13 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 24 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 21 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 4.2 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 25 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 150 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 113 | 50-150 |
| 13C2_6:2FTS | | 115 | 50-150 |
| 13C2_8:2FTS | | 110 | 50-150 |
| 13C2_PFDoA | | 91 | 50-150 |
| 13C2_PFTeDA | | 64 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 |
| 13C3_PFHxS | | 98 | 50-150 |
| 13C4_PFBA | | 66 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 |
| 13C6_PFDA | | 94 | 50-150 |
| 13C7_PFUdA | | 92 | 50-150 |
| 13C8_PFOA | | 94 | 50-150 |
| 13C8_PFOS | | 101 | 50-150 |
| 13C8_PFOSA | | 98 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XF17015-004 |
| Description: VRTB-D-P8_6132022 | | | Matrix: Aqueous |
| Date Sampled: 06/13/2022 1615 | | Project Name: ESTCP Vertebrae | |
| Date Received: 06/17/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 100 | 50-150 |
| d-MeFOSA | | 95 | 50-150 |
| d3-MeFOSAA | | 98 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-005
Description: Dup-01_06132022 | Matrix: Aqueous
Date Sampled: 06/13/2022 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/28/2022 1540 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.2 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.4 | J | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.5 | J | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 78 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 13 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 24 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 22 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 4.4 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 26 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 160 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 112 | 50-150 |
| 13C2_6:2FTS | | 113 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 |
| 13C2_PFDoA | | 90 | 50-150 |
| 13C2_PFTeDA | | 61 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 |
| 13C4_PFBA | | 58 | 50-150 |
| 13C4_PFHpA | | 94 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 90 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 |
| 13C8_PFOA | | 93 | 50-150 |
| 13C8_PFOS | | 94 | 50-150 |
| 13C8_PFOSA | | 99 | 50-150 |
| 13C9_PFNA | | 94 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XF17015-005 |
| Description: Dup-01_06132022 | | | Matrix: Aqueous |
| Date Sampled: 06/13/2022 | | Project Name: ESTCP Vertebrae | |
| Date Received: 06/17/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 96 | 50-150 |
| d-MeFOSA | | 92 | 50-150 |
| d3-MeFOSAA | | 97 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-006
Description: VRTB-S-B1_6132022 | Matrix: Aqueous
Date Sampled: 06/13/2022 1730 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/28/2022 1553 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.6 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.91 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.9 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 25 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 3.2 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 1.1 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 1.7 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 1.7 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 1.6 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 140 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 114 | 50-150 |
| 13C2_6:2FTS | | 112 | 50-150 |
| 13C2_8:2FTS | | 103 | 50-150 |
| 13C2_PFDoA | | 93 | 50-150 |
| 13C2_PFTeDA | | 72 | 50-150 |
| 13C3_PFBS | | 92 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 90 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 91 | 50-150 |
| 13C6_PFDA | | 88 | 50-150 |
| 13C7_PFUdA | | 84 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 |
| 13C8_PFOS | | 97 | 50-150 |
| 13C8_PFOSA | | 96 | 50-150 |
| 13C9_PFNA | | 93 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XF17015-006 |
| Description: VRTB-S-B1_6132022 | | | Matrix: Aqueous |
| Date Sampled: 06/13/2022 1730 | | Project Name: ESTCP Vertebrae | |
| Date Received: 06/17/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 96 | 50-150 |
| d-MeFOSA | | 75 | 50-150 |
| d3-MeFOSAA | | 96 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-007
Description: VRTB-S-S2_6132022 | Matrix: Aqueous
Date Sampled: 06/13/2022 1825 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/29/2022 1349 | MMM | 06/27/2022 1045 | 46201 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 06/29/2022 1338 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 5.8 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 6.5 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.89 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 7.2 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 140 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 7.2 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 17 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 12 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 4.9 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 20 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 9.5 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 680 | | 17 | 8.5 | 4.4 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 129 | 50-150 | | 127 | 50-150 |
| 13C2_6:2FTS | | 129 | 50-150 | | 120 | 50-150 |
| 13C2_8:2FTS | | 103 | 50-150 | | 114 | 50-150 |
| 13C2_PFDoA | | 72 | 50-150 | | 82 | 50-150 |
| 13C2_PFTeDA | | 51 | 50-150 | | 61 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 | | 108 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 | | 105 | 50-150 |
| 13C4_PFBA | | 91 | 50-150 | | 117 | 50-150 |
| 13C4_PFHpA | | 92 | 50-150 | | 109 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 | | 111 | 50-150 |
| 13C5_PFPeA | | 95 | 50-150 | | 108 | 50-150 |
| 13C6_PFDA | | 95 | 50-150 | | 110 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 | | 99 | 50-150 |
| 13C8_PFOA | | 98 | 50-150 | | 114 | 50-150 |
| 13C8_PFOS | | 89 | 50-150 | | 112 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 | | 119 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-007
Description: VRTB-S-S2_6132022
Matrix: Aqueous
Date Sampled: 06/13/2022 1825
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 89 | 50-150 | | 109 | 50-150 |
| d5-EtFOSAA | | 101 | 50-150 | | 116 | 50-150 |
| d-MeFOSA | | 76 | 50-150 | | 80 | 50-150 |
| d3-MeFOSAA | | 96 | 50-150 | | 110 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-008
Description: VRTB-S-Y3_6132022 | Matrix: Aqueous
Date Sampled: 06/13/2022 1905 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/28/2022 1619 | MMM | 06/27/2022 1045 | 46201 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 06/29/2022 1411 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 2.0 | J | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 5.9 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 19 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.1 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 12 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 320 | | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 8.1 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 9.9 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 20 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 4.0 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 14 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 12 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1200 | | 17 | 8.5 | 4.3 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 123 | 50-150 | | 147 | 50-150 |
| 13C2_6:2FTS | | 119 | 50-150 | | 133 | 50-150 |
| 13C2_8:2FTS | | 103 | 50-150 | | 128 | 50-150 |
| 13C2_PFDoA | | 74 | 50-150 | | 94 | 50-150 |
| 13C2_PFTeDA | N | 44 | 50-150 | | 65 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 | | 125 | 50-150 |
| 13C3_PFHxS | | 90 | 50-150 | | 132 | 50-150 |
| 13C4_PFBA | | 80 | 50-150 | | 133 | 50-150 |
| 13C4_PFHpA | | 96 | 50-150 | | 127 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 | | 134 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 | | 131 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 | | 118 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 | | 107 | 50-150 |
| 13C8_PFOA | | 97 | 50-150 | | 127 | 50-150 |
| 13C8_PFOS | | 90 | 50-150 | | 119 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 | | 131 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-008
Description: VRTB-S-Y3_6132022
Matrix: Aqueous
Date Sampled: 06/13/2022 1905
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 91 | 50-150 | | 121 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 | | 126 | 50-150 |
| d-MeFOSA | | 67 | 50-150 | | 82 | 50-150 |
| d3-MeFOSAA | | 103 | 50-150 | | 123 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-009
Description: VRTB-S-G4_6132022 | Matrix: Aqueous
Date Sampled: 06/13/2022 1945 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/28/2022 1631 | MMM | 06/27/2022 1045 | 46201 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 06/29/2022 1506 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.2 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 13 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 20 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 350 | | 18 | 9.0 | 4.4 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.7 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 6.7 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 16 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.4 | J | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 9.4 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 6.4 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 680 | | 18 | 9.0 | 4.4 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 119 | 50-150 | | 137 | 50-150 |
| 13C2_6:2FTS | | 116 | 50-150 | | 136 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 | | 120 | 50-150 |
| 13C2_PFDoA | | 95 | 50-150 | | 110 | 50-150 |
| 13C2_PFTeDA | | 77 | 50-150 | | 100 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 | | 121 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 | | 114 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 | | 127 | 50-150 |
| 13C4_PFHpA | | 91 | 50-150 | | 115 | 50-150 |
| 13C5_PFHxA | | 96 | 50-150 | | 121 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 | | 121 | 50-150 |
| 13C6_PFDA | | 94 | 50-150 | | 120 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 | | 116 | 50-150 |
| 13C8_PFOA | | 94 | 50-150 | | 122 | 50-150 |
| 13C8_PFOS | | 93 | 50-150 | | 120 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 | | 124 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-009
Description: VRTB-S-G4_6132022
Matrix: Aqueous
Date Sampled: 06/13/2022 1945
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 91 | 50-150 | | 122 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 | | 123 | 50-150 |
| d-MeFOSA | | 90 | 50-150 | | 109 | 50-150 |
| d3-MeFOSAA | | 100 | 50-150 | | 120 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-010
Description: VRTB-L-B1_6142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 0910 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/28/2022 1644 | MMM | 06/27/2022 1045 | 46201 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 06/29/2022 1517 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.8 | J | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 2.6 | J | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.2 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.2 | U | 8.4 | 4.2 | 2.1 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 10 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 15 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 19 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 230 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 10 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 14 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 23 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 8.6 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 39 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 17 | | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | UQ | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.2 | 2.1 | 1.1 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1000 | | 21 | 11 | 5.3 | ng/L | 2 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 101 | 50-150 | | 114 | 50-150 |
| 13C2_6:2FTS | | 96 | 50-150 | | 107 | 50-150 |
| 13C2_8:2FTS | | 86 | 50-150 | | 107 | 50-150 |
| 13C2_PFDoA | | 74 | 50-150 | | 93 | 50-150 |
| 13C2_PFTeDA | N | 44 | 50-150 | | 62 | 50-150 |
| 13C3_PFBS | | 77 | 50-150 | | 99 | 50-150 |
| 13C3_PFHxS | | 79 | 50-150 | | 97 | 50-150 |
| 13C4_PFBA | | 69 | 50-150 | | 107 | 50-150 |
| 13C4_PFHpA | | 79 | 50-150 | | 102 | 50-150 |
| 13C5_PFHxA | | 83 | 50-150 | | 102 | 50-150 |
| 13C5_PFPeA | | 76 | 50-150 | | 100 | 50-150 |
| 13C6_PFDA | | 77 | 50-150 | | 104 | 50-150 |
| 13C7_PFUdA | | 72 | 50-150 | | 102 | 50-150 |
| 13C8_PFOA | | 77 | 50-150 | | 103 | 50-150 |
| 13C8_PFOS | | 74 | 50-150 | | 102 | 50-150 |
| 13C8_PFOSA | | 80 | 50-150 | | 105 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-010
Description: VRTB-L-B1_6142022
Matrix: Aqueous
Date Sampled: 06/14/2022 0910
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 73 | 50-150 | | 100 | 50-150 |
| d5-EtFOSAA | | 83 | 50-150 | | 104 | 50-150 |
| d-MeFOSA | | 72 | 50-150 | | 99 | 50-150 |
| d3-MeFOSAA | | 80 | 50-150 | | 99 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-011
Description: VRTB-L-BB8_6142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1630 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/28/2022 1722 | MMM | 06/27/2022 1045 | 46201 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 50 | 06/29/2022 1528 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 10 | | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 15 | | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 15 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 27 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 25 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 540 | | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 44 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 52 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 100 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 24 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 54 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 110 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 85 | U | 170 | 85 | 43 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 5800 | | 170 | 85 | 43 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 68 | 50-150 | | 120 | 50-150 |
| 13C2_6:2FTS | | 73 | 50-150 | | 120 | 50-150 |
| 13C2_8:2FTS | | 66 | 50-150 | | 115 | 50-150 |
| 13C2_PFDoA | | 58 | 50-150 | | 105 | 50-150 |
| 13C2_PFTeDA | N | 41 | 50-150 | | 109 | 50-150 |
| 13C3_PFBS | | 59 | 50-150 | | 110 | 50-150 |
| 13C3_PFHxS | | 61 | 50-150 | | 109 | 50-150 |
| 13C4_PFBA | | 57 | 50-150 | | 114 | 50-150 |
| 13C4_PFHpA | | 59 | 50-150 | | 109 | 50-150 |
| 13C5_PFHxA | | 62 | 50-150 | | 113 | 50-150 |
| 13C5_PFPeA | | 60 | 50-150 | | 112 | 50-150 |
| 13C6_PFDA | | 61 | 50-150 | | 110 | 50-150 |
| 13C7_PFUdA | | 58 | 50-150 | | 112 | 50-150 |
| 13C8_PFOA | | 60 | 50-150 | | 115 | 50-150 |
| 13C8_PFOS | N | 48 | 50-150 | | 111 | 50-150 |
| 13C8_PFOSA | | 62 | 50-150 | | 120 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-011
Description: VRTB-L-BB8_6142022
Matrix: Aqueous
Date Sampled: 06/14/2022 1630
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 51 | 50-150 | | 108 | 50-150 |
| d5-EtFOSAA | | 64 | 50-150 | | 115 | 50-150 |
| d-MeFOSA | | 51 | 50-150 | | 116 | 50-150 |
| d3-MeFOSAA | | 64 | 50-150 | | 112 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-012
Description: VRTB-L-P7_6142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1545 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 06/28/2022 1735 | MMM | 06/27/2022 1045 | 46201 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 06/29/2022 1539 | MMM | 06/27/2022 1045 | 46201 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 39 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 77 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 10 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 65 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 24 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 790 | | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 37 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 92 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 99 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 54 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 140 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 88 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 13000 | | 340 | 170 | 86 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 123 | 50-150 | | 119 | 50-150 |
| 13C2_6:2FTS | | 112 | 50-150 | | 120 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 | | 122 | 50-150 |
| 13C2_PFDoA | | 82 | 50-150 | | 110 | 50-150 |
| 13C2_PFTeDA | N | 40 | 50-150 | | 111 | 50-150 |
| 13C3_PFBS | | 90 | 50-150 | | 113 | 50-150 |
| 13C3_PFHxS | | 86 | 50-150 | | 111 | 50-150 |
| 13C4_PFBA | | 73 | 50-150 | | 116 | 50-150 |
| 13C4_PFHpA | | 90 | 50-150 | | 107 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 | | 116 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | | 112 | 50-150 |
| 13C6_PFDA | | 88 | 50-150 | | 112 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 | | 113 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 | | 110 | 50-150 |
| 13C8_PFOS | N | 49 | 50-150 | | 114 | 50-150 |
| 13C8_PFOSA | | 94 | 50-150 | | 120 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-012
Description: VRTB-L-P7_6142022
Matrix: Aqueous
Date Sampled: 06/14/2022 1545
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 58 | 50-150 | | 112 | 50-150 |
| d5-EtFOSAA | | 91 | 50-150 | | 114 | 50-150 |
| d-MeFOSA | | 67 | 50-150 | | 117 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 | | 109 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-013
Description: VRTB-L-06_6142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1435 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/05/2022 1727 | MMM | 06/27/2022 1030 | 46282 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 200 | 07/06/2022 1813 | MMM | 06/27/2022 1030 | 46282 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/11/2022 1835 | MMM | 07/08/2022 1216 | 47402 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 35 | | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 75 | | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 8.2 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 45 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 9.0 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 490 | J | 680 | 340 | 170 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 51 | B | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 170 | | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 95 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 69 | Q | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 210 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 97 | | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 14000 | | 680 | 340 | 170 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 133 | 50-150 | | 100 | 50-150 | | 135 | 50-150 |
| 13C2_6:2FTS | | 104 | 50-150 | | 111 | 50-150 | | 120 | 50-150 |
| 13C2_8:2FTS | | 111 | 50-150 | | 110 | 50-150 | | 99 | 50-150 |
| 13C2_PFDoA | | 85 | 50-150 | | 91 | 50-150 | | 98 | 50-150 |
| 13C2_PFTeDA | | 59 | 50-150 | | 94 | 50-150 | | 69 | 50-150 |
| 13C3_PFBS | | 107 | 50-150 | | 95 | 50-150 | | 112 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 | | 95 | 50-150 | | 99 | 50-150 |
| 13C4_PFBA | | 96 | 50-150 | | 99 | 50-150 | | 104 | 50-150 |
| 13C4_PFHpA | | 96 | 50-150 | | 96 | 50-150 | | 98 | 50-150 |
| 13C5_PFHxA | | 100 | 50-150 | | 94 | 50-150 | | 106 | 50-150 |
| 13C5_PFPeA | | 97 | 50-150 | | 97 | 50-150 | | 104 | 50-150 |
| 13C6_PFDA | | 97 | 50-150 | | 95 | 50-150 | | 94 | 50-150 |
| 13C7_PFUdA | | 95 | 50-150 | | 96 | 50-150 | | 100 | 50-150 |
| 13C8_PFOA | | 91 | 50-150 | | 94 | 50-150 | | 99 | 50-150 |
| 13C8_PFOS | N | 46 | 50-150 | | 95 | 50-150 | N | 46 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-013
Description: VRTB-L-06_6142022
Matrix: Aqueous
Date Sampled: 06/14/2022 1435
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 105 | 50-150 | | 104 | 50-150 | | 109 | 50-150 |
| 13C9_PFNA | N | 47 | 50-150 | | 95 | 50-150 | N | 48 | 50-150 |
| d5-EtFOSAA | | 97 | 50-150 | | 94 | 50-150 | | 104 | 50-150 |
| d-MeFOSA | | 86 | 50-150 | | 95 | 50-150 | | 92 | 50-150 |
| d3-MeFOSAA | | 104 | 50-150 | | 102 | 50-150 | | 106 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-014
Description: VRTB-L-M5_6142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1340 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/05/2022 1738 | MMM | 06/27/2022 1030 | 46282 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 07/06/2022 1825 | MMM | 06/27/2022 1030 | 46282 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/11/2022 1846 | MMM | 07/08/2022 1216 | 47402 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 30 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 56 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.0 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 32 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 19 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 510 | | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 36 | B | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 110 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 97 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 44 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 100 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 79 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 7100 | | 350 | 180 | 87 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 138 | 50-150 | | 103 | 50-150 | | 145 | 50-150 |
| 13C2_6:2FTS | | 107 | 50-150 | | 116 | 50-150 | | 135 | 50-150 |
| 13C2_8:2FTS | | 114 | 50-150 | | 116 | 50-150 | | 104 | 50-150 |
| 13C2_PFDoA | | 89 | 50-150 | | 102 | 50-150 | | 101 | 50-150 |
| 13C2_PFTeDA | | 62 | 50-150 | | 101 | 50-150 | | 74 | 50-150 |
| 13C3_PFBS | | 106 | 50-150 | | 103 | 50-150 | | 115 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 | | 101 | 50-150 | | 97 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 | | 105 | 50-150 | | 104 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 | | 102 | 50-150 | | 101 | 50-150 |
| 13C5_PFHxA | | 98 | 50-150 | | 104 | 50-150 | | 110 | 50-150 |
| 13C5_PFPeA | | 98 | 50-150 | | 102 | 50-150 | | 106 | 50-150 |
| 13C6_PFDA | | 97 | 50-150 | | 103 | 50-150 | | 100 | 50-150 |
| 13C7_PFUdA | | 98 | 50-150 | | 101 | 50-150 | | 103 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 | | 99 | 50-150 | | 107 | 50-150 |
| 13C8_PFOS | | 61 | 50-150 | | 100 | 50-150 | | 64 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-014
Description: VRTB-L-M5_6142022
Matrix: Aqueous
Date Sampled: 06/14/2022 1340
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 108 | 50-150 | | 112 | 50-150 | | 113 | 50-150 |
| 13C9_PFNA | | 61 | 50-150 | | 103 | 50-150 | | 64 | 50-150 |
| d5-EtFOSAA | | 100 | 50-150 | | 100 | 50-150 | | 108 | 50-150 |
| d-MeFOSA | | 83 | 50-150 | | 101 | 50-150 | | 99 | 50-150 |
| d3-MeFOSAA | | 104 | 50-150 | | 109 | 50-150 | | 109 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-015
Description: VRTB-L-G4_6142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1205 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/05/2022 1748 | MMM | 06/27/2022 1030 | 46282 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 07/06/2022 1838 | MMM | 06/27/2022 1030 | 46282 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/11/2022 1857 | MMM | 07/08/2022 1216 | 47402 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 31 | | 7.5 | 3.8 | 1.9 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 60 | | 7.5 | 3.8 | 1.9 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.8 | U | 7.5 | 3.8 | 1.9 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.8 | U | 7.5 | 3.8 | 1.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.5 | U | 15 | 7.5 | 3.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.8 | U | 7.5 | 3.8 | 1.9 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 15 | | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 36 | | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 45 | | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1100 | | 37 | 19 | 9.4 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 53 | B | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 120 | | 3.6 | 1.8 | 0.90 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 190 | | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 18 | | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 130 | | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 95 | | 3.6 | 1.8 | 0.90 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.94 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2100 | | 37 | 19 | 9.4 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 123 | 50-150 | | 89 | 50-150 | | 136 | 50-150 |
| 13C2_6:2FTS | | 98 | 50-150 | | 98 | 50-150 | | 120 | 50-150 |
| 13C2_8:2FTS | | 99 | 50-150 | | 87 | 50-150 | | 104 | 50-150 |
| 13C2_PFDoA | | 66 | 50-150 | | 63 | 50-150 | | 102 | 50-150 |
| 13C2_PFTeDA | | 54 | 50-150 | | 55 | 50-150 | | 79 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 | | 93 | 50-150 | | 118 | 50-150 |
| 13C3_PFHxS | | 78 | 50-150 | | 86 | 50-150 | | 95 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 | | 93 | 50-150 | | 103 | 50-150 |
| 13C4_PFHpA | | 86 | 50-150 | | 93 | 50-150 | | 95 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 | | 89 | 50-150 | | 102 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 | | 90 | 50-150 | | 105 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 | | 84 | 50-150 | | 102 | 50-150 |
| 13C7_PFUdA | | 80 | 50-150 | | 74 | 50-150 | | 107 | 50-150 |
| 13C8_PFOA | | 91 | 50-150 | | 87 | 50-150 | | 100 | 50-150 |
| 13C8_PFOS | | 80 | 50-150 | | 86 | 50-150 | | 91 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-015
Description: VRTB-L-G4_6142022
Matrix: Aqueous
Date Sampled: 06/14/2022 1205
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 98 | 50-150 | | 95 | 50-150 | | 112 | 50-150 |
| 13C9_PFNA | | 79 | 50-150 | | 90 | 50-150 | | 88 | 50-150 |
| d5-EtFOSAA | | 79 | 50-150 | | 76 | 50-150 | | 105 | 50-150 |
| d-MeFOSA | | 73 | 50-150 | | 69 | 50-150 | | 95 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 | | 80 | 50-150 | | 108 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-016
Description: VRTB-L-Y3_6142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1115 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/05/2022 1759 | MMM | 06/27/2022 1030 | 46282 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 07/11/2022 1213 | MMM | 06/27/2022 1030 | 46282 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/11/2022 1908 | MMM | 07/08/2022 1216 | 47402 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 93 | | 7.5 | 3.8 | 1.9 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 130 | | 7.5 | 3.8 | 1.9 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.8 | U | 7.5 | 3.8 | 1.9 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.8 | U | 7.5 | 3.8 | 1.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.5 | U | 15 | 7.5 | 3.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.8 | U | 7.5 | 3.8 | 1.9 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 6.1 | | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 90 | | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | J | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 24 | | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 2300 | | 75 | 38 | 19 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 53 | B | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 110 | | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 130 | | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 45 | | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 410 | | 75 | 38 | 19 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 72 | | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 4500 | | 75 | 38 | 19 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 116 | 50-150 | | 86 | 50-150 | | 132 | 50-150 |
| 13C2_6:2FTS | | 92 | 50-150 | | 100 | 50-150 | | 128 | 50-150 |
| 13C2_8:2FTS | | 93 | 50-150 | | 89 | 50-150 | | 103 | 50-150 |
| 13C2_PFDoA | | 60 | 50-150 | | 63 | 50-150 | | 111 | 50-150 |
| 13C2_PFTeDA | | 53 | 50-150 | N | 48 | 50-150 | | 88 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 | | 79 | 50-150 | | 117 | 50-150 |
| 13C3_PFHxS | | 72 | 50-150 | | 78 | 50-150 | | 82 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 | | 84 | 50-150 | | 107 | 50-150 |
| 13C4_PFHpA | | 77 | 50-150 | | 81 | 50-150 | | 93 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 | | 83 | 50-150 | | 109 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 | | 81 | 50-150 | | 105 | 50-150 |
| 13C6_PFDA | | 85 | 50-150 | | 67 | 50-150 | | 100 | 50-150 |
| 13C7_PFUdA | | 76 | 50-150 | | 59 | 50-150 | | 109 | 50-150 |
| 13C8_PFOA | | 83 | 50-150 | | 80 | 50-150 | | 100 | 50-150 |
| 13C8_PFOS | | 67 | 50-150 | | 78 | 50-150 | | 81 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-016
Description: VRTB-L-Y3_6142022
Matrix: Aqueous
Date Sampled: 06/14/2022 1115
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 96 | 50-150 | | 83 | 50-150 | | 112 | 50-150 |
| 13C9_PFNA | | 67 | 50-150 | | 75 | 50-150 | | 75 | 50-150 |
| d5-EtFOSAA | | 71 | 50-150 | | 67 | 50-150 | | 107 | 50-150 |
| d-MeFOSA | | 65 | 50-150 | | 70 | 50-150 | | 97 | 50-150 |
| d3-MeFOSAA | | 81 | 50-150 | | 72 | 50-150 | | 108 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-017
Description: VRTB-L-S2_6142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1025 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/05/2022 1810 | MMM | 06/27/2022 1030 | 46282 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 07/06/2022 1904 | MMM | 06/27/2022 1030 | 46282 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/11/2022 1919 | MMM | 07/08/2022 1216 | 47402 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 38 | | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 80 | | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.0 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.0 | U | 8.0 | 4.0 | 2.0 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 11 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 44 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 23 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1100 | | 80 | 40 | 20 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 23 | B | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 49 | | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 62 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 44 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 180 | | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 27 | | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.0 | UQ | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.0 | U | 4.0 | 2.0 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 5600 | | 80 | 40 | 20 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 113 | 50-150 | | 85 | 50-150 | | 139 | 50-150 |
| 13C2_6:2FTS | | 88 | 50-150 | | 90 | 50-150 | | 122 | 50-150 |
| 13C2_8:2FTS | | 93 | 50-150 | | 87 | 50-150 | | 97 | 50-150 |
| 13C2_PFDoA | | 70 | 50-150 | | 59 | 50-150 | | 95 | 50-150 |
| 13C2_PFTeDA | N | 44 | 50-150 | N | 44 | 50-150 | | 64 | 50-150 |
| 13C3_PFBS | | 92 | 50-150 | | 79 | 50-150 | | 116 | 50-150 |
| 13C3_PFHxS | | 78 | 50-150 | | 66 | 50-150 | | 100 | 50-150 |
| 13C4_PFBA | | 85 | 50-150 | | 83 | 50-150 | | 108 | 50-150 |
| 13C4_PFHpA | | 80 | 50-150 | | 77 | 50-150 | | 96 | 50-150 |
| 13C5_PFHxA | | 88 | 50-150 | | 79 | 50-150 | | 107 | 50-150 |
| 13C5_PFPeA | | 85 | 50-150 | | 79 | 50-150 | | 108 | 50-150 |
| 13C6_PFDA | | 79 | 50-150 | | 74 | 50-150 | | 95 | 50-150 |
| 13C7_PFUdA | | 80 | 50-150 | | 77 | 50-150 | | 97 | 50-150 |
| 13C8_PFOA | | 77 | 50-150 | | 75 | 50-150 | | 103 | 50-150 |
| 13C8_PFOS | | 61 | 50-150 | | 75 | 50-150 | | 69 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-017
Description: VRTB-L-S2_6142022
Matrix: Aqueous
Date Sampled: 06/14/2022 1025
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 88 | 50-150 | | 78 | 50-150 | | 107 | 50-150 |
| 13C9_PFNA | | 62 | 50-150 | | 75 | 50-150 | | 70 | 50-150 |
| d5-EtFOSAA | | 80 | 50-150 | | 75 | 50-150 | | 99 | 50-150 |
| d-MeFOSA | | 70 | 50-150 | | 70 | 50-150 | | 87 | 50-150 |
| d3-MeFOSAA | | 85 | 50-150 | | 79 | 50-150 | | 102 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-018
Description: Dup-02_06142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/05/2022 1821 | MMM | 06/27/2022 1030 | 46282 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 50 | 07/07/2022 1440 | MMM | 06/27/2022 1030 | 46282 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/11/2022 1930 | MMM | 07/08/2022 1216 | 47402 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 45 | | 9.1 | 4.6 | 2.3 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 86 | | 9.1 | 4.6 | 2.3 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.6 | U | 9.1 | 4.6 | 2.3 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.6 | U | 9.1 | 4.6 | 2.3 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 9.0 | U | 18 | 9.0 | 4.6 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.6 | U | 9.1 | 4.6 | 2.3 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 13 | | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.3 | U | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 51 | | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.3 | U | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.3 | U | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 27 | | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 720 | | 230 | 120 | 57 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 27 | B | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.3 | U | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.3 | U | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 46 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 74 | | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 50 | | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 200 | | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 26 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.3 | UQ | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.3 | U | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.3 | U | 4.6 | 2.3 | 1.1 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 3900 | | 230 | 120 | 57 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 | | 120 | 50-150 | | 142 | 50-150 |
| 13C2_6:2FTS | | 87 | 50-150 | | 118 | 50-150 | | 140 | 50-150 |
| 13C2_8:2FTS | | 83 | 50-150 | | 119 | 50-150 | | 113 | 50-150 |
| 13C2_PFDoA | | 62 | 50-150 | | 105 | 50-150 | | 103 | 50-150 |
| 13C2_PFTeDA | N | 40 | 50-150 | | 103 | 50-150 | | 70 | 50-150 |
| 13C3_PFBS | | 79 | 50-150 | | 106 | 50-150 | | 117 | 50-150 |
| 13C3_PFHxS | | 74 | 50-150 | | 107 | 50-150 | | 101 | 50-150 |
| 13C4_PFBA | | 78 | 50-150 | | 107 | 50-150 | | 110 | 50-150 |
| 13C4_PFHpA | | 74 | 50-150 | | 106 | 50-150 | | 104 | 50-150 |
| 13C5_PFHxA | | 76 | 50-150 | | 108 | 50-150 | | 111 | 50-150 |
| 13C5_PFPeA | | 73 | 50-150 | | 105 | 50-150 | | 110 | 50-150 |
| 13C6_PFDA | | 72 | 50-150 | | 102 | 50-150 | | 103 | 50-150 |
| 13C7_PFUdA | | 71 | 50-150 | | 106 | 50-150 | | 104 | 50-150 |
| 13C8_PFOA | | 74 | 50-150 | | 108 | 50-150 | | 105 | 50-150 |
| 13C8_PFOS | | 54 | 50-150 | | 111 | 50-150 | | 70 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-018
Description: Dup-02_06142022
Matrix: Aqueous
Date Sampled: 06/14/2022
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 82 | 50-150 | | 121 | 50-150 | | 114 | 50-150 |
| 13C9_PFNA | | 56 | 50-150 | | 104 | 50-150 | | 72 | 50-150 |
| d5-EtFOSAA | | 73 | 50-150 | | 107 | 50-150 | | 108 | 50-150 |
| d-MeFOSA | | 63 | 50-150 | | 103 | 50-150 | | 100 | 50-150 |
| d3-MeFOSAA | | 77 | 50-150 | | 112 | 50-150 | | 107 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-019
Description: MW-VRTB-2D_06142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1740 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/05/2022 1905 | MMM | 06/27/2022 1030 | 46282 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 07/06/2022 1954 | MMM | 06/27/2022 1030 | 46282 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/10/2022 1643 | LAB | 07/07/2022 1706 | 47309 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 19 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 19 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 24 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 350 | | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 19 | B | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 11 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 28 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.4 | J | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 56 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 16 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 520 | | 17 | 8.5 | 4.3 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 | | 96 | 50-150 | | 111 | 50-150 |
| 13C2_6:2FTS | | 104 | 50-150 | | 113 | 50-150 | N | 277 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 | | 100 | 50-150 | | 122 | 50-150 |
| 13C2_PFDoA | | 81 | 50-150 | | 85 | 50-150 | | 83 | 50-150 |
| 13C2_PFTeDA | | 76 | 50-150 | | 80 | 50-150 | | 99 | 50-150 |
| 13C3_PFBS | | 102 | 50-150 | | 96 | 50-150 | | 104 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 | | 92 | 50-150 | | 83 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 | | 98 | 50-150 | | 99 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 | | 93 | 50-150 | | 98 | 50-150 |
| 13C5_PFHxA | | 98 | 50-150 | | 96 | 50-150 | | 111 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 | | 99 | 50-150 | | 99 | 50-150 |
| 13C6_PFDA | | 89 | 50-150 | | 88 | 50-150 | | 96 | 50-150 |
| 13C7_PFUdA | | 86 | 50-150 | | 90 | 50-150 | | 97 | 50-150 |
| 13C8_PFOA | | 96 | 50-150 | | 98 | 50-150 | | 92 | 50-150 |
| 13C8_PFOS | | 95 | 50-150 | | 93 | 50-150 | | 97 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-019
Description: MW-VRTB-2D_06142022
Matrix: Aqueous
Date Sampled: 06/14/2022 1740
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 99 | 50-150 | | 101 | 50-150 | | 114 | 50-150 |
| 13C9_PFNA | | 90 | 50-150 | | 97 | 50-150 | | 89 | 50-150 |
| d5-EtFOSAA | | 89 | 50-150 | | 93 | 50-150 | | 98 | 50-150 |
| d-MeFOSA | | 75 | 50-150 | | 75 | 50-150 | | 83 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 | | 95 | 50-150 | | 106 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17015-020
Description: MW-VRTB-2S_06142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1815 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/05/2022 1854 | MMM | 06/27/2022 1030 | 46282 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 07/06/2022 2007 | MMM | 06/27/2022 1030 | 46282 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/10/2022 1654 | LAB | 07/07/2022 1706 | 47309 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 7.6 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 28 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 11 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | US | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 38 | S | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | US | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 22 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 670 | | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 33 | B | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 64 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 91 | S | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 31 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 110 | S | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 71 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 6200 | | 340 | 170 | 86 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 132 | 50-150 | | 94 | 50-150 | | 118 | 50-150 |
| 13C2_6:2FTS | | 125 | 50-150 | | 110 | 50-150 | N | 196 | 50-150 |
| 13C2_8:2FTS | | 115 | 50-150 | | 108 | 50-150 | | 121 | 50-150 |
| 13C2_PFDoA | | 80 | 50-150 | | 90 | 50-150 | | 84 | 50-150 |
| 13C2_PFTeDA | | 75 | 50-150 | | 90 | 50-150 | | 92 | 50-150 |
| 13C3_PFBS | | 113 | 50-150 | | 95 | 50-150 | | 97 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 | | 90 | 50-150 | | 87 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 | | 97 | 50-150 | | 93 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 | | 91 | 50-150 | | 102 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 | | 94 | 50-150 | | 98 | 50-150 |
| 13C5_PFPeA | | 104 | 50-150 | | 93 | 50-150 | | 96 | 50-150 |
| 13C6_PFDA | | 97 | 50-150 | | 92 | 50-150 | | 97 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 | | 91 | 50-150 | | 96 | 50-150 |
| 13C8_PFOA | | 104 | 50-150 | | 91 | 50-150 | | 102 | 50-150 |
| 13C8_PFOS | | 64 | 50-150 | | 89 | 50-150 | | 57 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17015-020
Description: MW-VRTB-2S_06142022
Matrix: Aqueous
Date Sampled: 06/14/2022 1815
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 109 | 50-150 | | 105 | 50-150 | | 113 | 50-150 |
| 13C9_PFNA | | 67 | 50-150 | | 93 | 50-150 | | 59 | 50-150 |
| d5-EtFOSAA | | 90 | 50-150 | | 93 | 50-150 | | 92 | 50-150 |
| d-MeFOSA | | 84 | 50-150 | | 95 | 50-150 | | 81 | 50-150 |
| d3-MeFOSAA | | 99 | 50-150 | | 101 | 50-150 | | 106 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: XQ46201-001
Batch: 46201
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1045

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 06/30/2022 1205 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 06/30/2022 1205 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 06/30/2022 1205 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 06/30/2022 1205 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 06/30/2022 1205 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 06/30/2022 1205 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 06/30/2022 1205 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 106 | 50-150 |
| 13C2_6:2FTS | | 113 | 50-150 |
| 13C2_8:2FTS | | 103 | 50-150 |
| 13C2_PFDoA | | 100 | 50-150 |
| 13C2_PFTeDA | | 93 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 |
| 13C3_PFHxS | | 103 | 50-150 |
| 13C4_PFBA | | 100 | 50-150 |
| 13C4_PFHpA | | 100 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 104 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 |
| 13C7_PFUdA | | 97 | 50-150 |
| 13C8_PFOA | | 108 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ46201-001
Batch: 46201
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1045

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 102 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 |
| 13C9_PFNA | | 101 | 50-150 |
| d5-EtFOSAA | | 103 | 50-150 |
| d-MeFOSA | | 60 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ46201-002
Batch: 46201
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1045

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 14 | | 1 | 90 | 67-138 | 06/28/2022 1424 |
| 6:2 FTS | 15 | 15 | | 1 | 99 | 64-140 | 06/28/2022 1424 |
| 4:2 FTS | 15 | 14 | | 1 | 96 | 63-143 | 06/28/2022 1424 |
| EtFOSAA | 16 | 16 | | 1 | 102 | 61-135 | 06/28/2022 1424 |
| MeFOSA | 16 | 17 | | 1 | 107 | 68-141 | 06/28/2022 1424 |
| MeFOSAA | 16 | 15 | | 1 | 91 | 65-136 | 06/28/2022 1424 |
| PFBS | 14 | 15 | | 1 | 107 | 72-130 | 06/28/2022 1424 |
| PFDS | 15 | 15 | | 1 | 100 | 53-142 | 06/28/2022 1424 |
| PFHpS | 15 | 16 | | 1 | 104 | 69-134 | 06/28/2022 1424 |
| PFNS | 15 | 15 | | 1 | 95 | 69-127 | 06/28/2022 1424 |
| PFOSA | 16 | 17 | | 1 | 107 | 67-137 | 06/28/2022 1424 |
| PFPeS | 15 | 16 | | 1 | 109 | 71-127 | 06/28/2022 1424 |
| PFHxS | 15 | 15 | | 1 | 106 | 68-131 | 06/28/2022 1424 |
| PFBA | 16 | 17 | | 1 | 106 | 73-129 | 06/28/2022 1424 |
| PFDA | 16 | 17 | | 1 | 106 | 71-129 | 06/28/2022 1424 |
| PFDoA | 16 | 17 | | 1 | 108 | 72-134 | 06/28/2022 1424 |
| PFHpA | 16 | 18 | | 1 | 111 | 72-130 | 06/28/2022 1424 |
| PFHxA | 16 | 16 | | 1 | 100 | 72-129 | 06/28/2022 1424 |
| PFNA | 16 | 17 | | 1 | 106 | 69-130 | 06/28/2022 1424 |
| PFOA | 16 | 17 | | 1 | 105 | 71-133 | 06/28/2022 1424 |
| PFPeA | 16 | 17 | | 1 | 106 | 72-129 | 06/28/2022 1424 |
| PFTeDA | 16 | 16 | | 1 | 102 | 71-132 | 06/28/2022 1424 |
| PFTrDA | 16 | 17 | | 1 | 106 | 65-144 | 06/28/2022 1424 |
| PFUdA | 16 | 16 | | 1 | 97 | 69-133 | 06/28/2022 1424 |
| PFOS | 15 | 14 | | 1 | 95 | 65-140 | 06/28/2022 1424 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 |
| 13C2_6:2FTS | | 103 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 |
| 13C2_PFDoA | | 89 | 50-150 |
| 13C2_PFTeDA | | 80 | 50-150 |
| 13C3_PFBS | | 90 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 |
| 13C4_PFBA | | 96 | 50-150 |
| 13C4_PFHpA | | 91 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 89 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ46201-002
Batch: 46201
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1045

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 96 | 50-150 |
| 13C8_PFOSA | | 89 | 50-150 |
| 13C9_PFNA | | 89 | 50-150 |
| d5-EtFOSAA | | 94 | 50-150 |
| d-MeFOSA | | 54 | 50-150 |
| d3-MeFOSAA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ46282-001
Batch: 46282
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1030

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/05/2022 1705 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/05/2022 1705 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/05/2022 1705 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/05/2022 1705 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 07/05/2022 1705 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/05/2022 1705 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFBA | 1.0 | J | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/05/2022 1705 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 116 | 50-150 |
| 13C2_6:2FTS | | 118 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 |
| 13C2_PFDoA | | 90 | 50-150 |
| 13C2_PFTeDA | | 76 | 50-150 |
| 13C3_PFBS | | 105 | 50-150 |
| 13C3_PFHxS | | 103 | 50-150 |
| 13C4_PFBA | | 100 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 |
| 13C5_PFHxA | | 100 | 50-150 |
| 13C5_PFPeA | | 95 | 50-150 |
| 13C6_PFDA | | 92 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 |
| 13C8_PFOA | | 98 | 50-150 |
| 13C8_PFOS | | 101 | 50-150 |
| 13C8_PFOSA | | 102 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ46282-001
Batch: 46282
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1030

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C9_PFNA | | 95 | 50-150 |
| d5-EtFOSAA | | 96 | 50-150 |
| d-MeFOSA | | 88 | 50-150 |
| d3-MeFOSAA | | 101 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ46282-002
Batch: 46282
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1030

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 14 | | 1 | 92 | 67-138 | 07/05/2022 1716 |
| 6:2 FTS | 15 | 17 | | 1 | 115 | 64-140 | 07/05/2022 1716 |
| 4:2 FTS | 15 | 16 | | 1 | 106 | 63-143 | 07/05/2022 1716 |
| EtFOSAA | 16 | 16 | | 1 | 103 | 61-135 | 07/05/2022 1716 |
| MeFOSA | 16 | 19 | | 1 | 119 | 68-141 | 07/05/2022 1716 |
| MeFOSAA | 16 | 17 | | 1 | 103 | 65-136 | 07/05/2022 1716 |
| PFBS | 14 | 14 | | 1 | 102 | 72-130 | 07/05/2022 1716 |
| PFDS | 15 | 15 | | 1 | 98 | 53-142 | 07/05/2022 1716 |
| PFHpS | 15 | 16 | | 1 | 108 | 69-134 | 07/05/2022 1716 |
| PFNS | 15 | 15 | | 1 | 99 | 69-127 | 07/05/2022 1716 |
| PFOSA | 16 | 17 | | 1 | 106 | 67-137 | 07/05/2022 1716 |
| PFPeS | 15 | 14 | | 1 | 96 | 71-127 | 07/05/2022 1716 |
| PFHxS | 15 | 15 | | 1 | 101 | 68-131 | 07/05/2022 1716 |
| PFBA | 16 | 21 | | 1 | 129 | 73-129 | 07/05/2022 1716 |
| PFDA | 16 | 17 | | 1 | 104 | 71-129 | 07/05/2022 1716 |
| PFDoA | 16 | 18 | | 1 | 111 | 72-134 | 07/05/2022 1716 |
| PFHxA | 16 | 19 | | 1 | 116 | 72-129 | 07/05/2022 1716 |
| PFNA | 16 | 17 | | 1 | 104 | 69-130 | 07/05/2022 1716 |
| PFOA | 16 | 17 | | 1 | 107 | 71-133 | 07/05/2022 1716 |
| PFTeDA | 16 | 17 | | 1 | 108 | 71-132 | 07/05/2022 1716 |
| PFTrDA | 16 | 18 | | 1 | 110 | 65-144 | 07/05/2022 1716 |
| PFUdA | 16 | 17 | | 1 | 106 | 69-133 | 07/05/2022 1716 |
| PFOS | 15 | 15 | | 1 | 102 | 65-140 | 07/05/2022 1716 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 95 | 50-150 |
| 13C2_6:2FTS | | 83 | 50-150 |
| 13C2_8:2FTS | | 79 | 50-150 |
| 13C2_PFDoA | | 62 | 50-150 |
| 13C2_PFTeDA | | 65 | 50-150 |
| 13C3_PFBS | | 86 | 50-150 |
| 13C3_PFHxS | | 81 | 50-150 |
| 13C4_PFBA | | 81 | 50-150 |
| 13C4_PFHpA | | 74 | 50-150 |
| 13C5_PFHxA | | 82 | 50-150 |
| 13C5_PFPeA | | 79 | 50-150 |
| 13C6_PFDA | | 69 | 50-150 |
| 13C7_PFUdA | | 68 | 50-150 |
| 13C8_PFOA | | 78 | 50-150 |
| 13C8_PFOS | | 73 | 50-150 |
| 13C8_PFOSA | | 71 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ46282-002
Batch: 46282
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1030

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C9_PFNA | | 78 | 50-150 |
| d5-EtFOSAA | | 68 | 50-150 |
| d-MeFOSA | | 62 | 50-150 |
| d3-MeFOSAA | | 71 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XF17015-020MS
Batch: 46282
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1030

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 7.6 | 13 | 21 | | 1 | 103 | 67-138 | 07/05/2022 1832 |
| 6:2 FTS | 28 | 13 | 43 | | 1 | 117 | 64-140 | 07/05/2022 1832 |
| 4:2 FTS | ND | 13 | 13 | | 1 | 102 | 63-143 | 07/05/2022 1832 |
| EtFOSAA | ND | 14 | 14 | | 1 | 106 | 61-135 | 07/05/2022 1832 |
| MeFOSA | ND | 14 | 15 | | 1 | 110 | 68-141 | 07/05/2022 1832 |
| MeFOSAA | ND | 14 | 14 | | 1 | 102 | 65-136 | 07/05/2022 1832 |
| PFBS | 11 | 12 | 26 | | 1 | 122 | 72-130 | 07/05/2022 1832 |
| PFDS | ND | 13 | 21 | N | 1 | 158 | 53-142 | 07/05/2022 1832 |
| PFHpS | 38 | 13 | 56 | N | 1 | 146 | 69-134 | 07/05/2022 1832 |
| PFNS | ND | 13 | 21 | N | 1 | 164 | 69-127 | 07/05/2022 1832 |
| PFOSA | ND | 14 | 15 | | 1 | 109 | 67-137 | 07/05/2022 1832 |
| PFPeS | 22 | 13 | 35 | | 1 | 98 | 71-127 | 07/05/2022 1832 |
| PFHxS | 760 | 12 | 840 | N | 1 | 629 | 68-131 | 07/05/2022 1832 |
| PFBA | 33 | 14 | 49 | | 1 | 120 | 73-129 | 07/05/2022 1832 |
| PFDA | ND | 14 | 16 | | 1 | 114 | 71-129 | 07/05/2022 1832 |
| PFDoA | ND | 14 | 15 | | 1 | 107 | 72-134 | 07/05/2022 1832 |
| PFHxA | 91 | 14 | 110 | N | 1 | 148 | 72-129 | 07/05/2022 1832 |
| PFNA | 31 | 14 | 47 | | 1 | 120 | 69-130 | 07/05/2022 1832 |
| PFOA | 110 | 14 | 130 | N | 1 | 136 | 71-133 | 07/05/2022 1832 |
| PFTeDA | ND | 14 | 15 | | 1 | 112 | 71-132 | 07/05/2022 1832 |
| PFTrDA | ND | 14 | 14 | | 1 | 103 | 65-144 | 07/05/2022 1832 |
| PFUdA | ND | 14 | 15 | | 1 | 109 | 69-133 | 07/05/2022 1832 |
| PFOS | 7200 | 13 | 7300 | N | 1 | 939 | 65-140 | 07/05/2022 1832 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 124 | 50-150 |
| 13C2_6:2FTS | | 117 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 |
| 13C2_PFDoA | | 81 | 50-150 |
| 13C2_PFTeDA | | 80 | 50-150 |
| 13C3_PFBS | | 104 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 |
| 13C4_PFBA | | 90 | 50-150 |
| 13C4_PFHpA | | 91 | 50-150 |
| 13C5_PFHxA | | 100 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 89 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 |
| 13C8_PFOA | | 97 | 50-150 |
| 13C8_PFOS | | 61 | 50-150 |
| 13C8_PFOSA | | 102 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XF17015-020MS
Batch: 46282
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1030

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C9_PFNA | | 62 | 50-150 |
| d5-EtFOSAA | | 88 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: XF17015-020MD
Batch: 46282
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1030

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 7.6 | 13 | 18 | | 1 | 80 | 16 | 67-138 | 30 | 07/05/2022 1843 |
| 6:2 FTS | 28 | 13 | 41 | | 1 | 100 | 5.5 | 64-140 | 30 | 07/05/2022 1843 |
| 4:2 FTS | ND | 13 | 12 | | 1 | 91 | 12 | 63-143 | 30 | 07/05/2022 1843 |
| EtFOSAA | ND | 14 | 13 | | 1 | 98 | 8.7 | 61-135 | 30 | 07/05/2022 1843 |
| MeFOSA | ND | 14 | 14 | | 1 | 102 | 7.9 | 68-141 | 30 | 07/05/2022 1843 |
| MeFOSAA | ND | 14 | 13 | | 1 | 93 | 10 | 65-136 | 30 | 07/05/2022 1843 |
| PFBS | 11 | 12 | 24 | | 1 | 103 | 9.8 | 72-130 | 30 | 07/05/2022 1843 |
| PFDS | ND | 13 | 18 | | 1 | 140 | 14 | 53-142 | 30 | 07/05/2022 1843 |
| PFHpS | 38 | 13 | 52 | | 1 | 110 | 8.7 | 69-134 | 30 | 07/05/2022 1843 |
| PFNS | ND | 13 | 20 | N | 1 | 158 | 4.6 | 69-127 | 30 | 07/05/2022 1843 |
| PFOSA | ND | 14 | 13 | | 1 | 99 | 11 | 67-137 | 30 | 07/05/2022 1843 |
| PFPeS | 22 | 13 | 32 | | 1 | 75 | 9.1 | 71-127 | 30 | 07/05/2022 1843 |
| PFHxS | 760 | 12 | 750 | N | 1 | -84 | 11 | 68-131 | 30 | 07/05/2022 1843 |
| PFBA | 33 | 14 | 45 | | 1 | 90 | 9.0 | 73-129 | 30 | 07/05/2022 1843 |
| PFDA | ND | 14 | 13 | | 1 | 99 | 14 | 71-129 | 30 | 07/05/2022 1843 |
| PFDoA | ND | 14 | 13 | | 1 | 100 | 7.9 | 72-134 | 30 | 07/05/2022 1843 |
| PFHxA | 91 | 14 | 100 | | 1 | 74 | 9.6 | 72-129 | 30 | 07/05/2022 1843 |
| PFNA | 31 | 14 | 42 | | 1 | 80 | 12 | 69-130 | 30 | 07/05/2022 1843 |
| PFOA | 110 | 14 | 120 | N | 1 | 58 | 8.8 | 71-133 | 30 | 07/05/2022 1843 |
| PFTeDA | ND | 14 | 14 | | 1 | 103 | 8.9 | 71-132 | 30 | 07/05/2022 1843 |
| PFTrDA | ND | 14 | 14 | | 1 | 102 | 2.4 | 65-144 | 30 | 07/05/2022 1843 |
| PFUdA | ND | 14 | 13 | | 1 | 99 | 11 | 69-133 | 30 | 07/05/2022 1843 |
| PFOS | 7200 | 13 | 6400 | N | 1 | -6710 | 14 | 65-140 | 30 | 07/05/2022 1843 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 149 | 50-150 |
| 13C2_6:2FTS | | 133 | 50-150 |
| 13C2_8:2FTS | | 118 | 50-150 |
| 13C2_PFDoA | | 89 | 50-150 |
| 13C2_PFTeDA | | 90 | 50-150 |
| 13C3_PFBS | | 122 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 |
| 13C4_PFBA | | 102 | 50-150 |
| 13C4_PFHpA | | 100 | 50-150 |
| 13C5_PFHxA | | 112 | 50-150 |
| 13C5_PFPeA | | 108 | 50-150 |
| 13C6_PFDA | | 105 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 111 | 50-150 |
| 13C8_PFOS | | 71 | 50-150 |
| 13C8_PFOSA | | 118 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: XF17015-020MD
Batch: 46282
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 06/27/2022 1030

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C9_PFNA | | 71 | 50-150 |
| d5-EtFOSAA | | 96 | 50-150 |
| d-MeFOSA | | 88 | 50-150 |
| d3-MeFOSAA | | 108 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47309-001
Batch: 47309
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/07/2022 1706

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 118 | 50-150 |
| 13C2_6:2FTS | N | 151 | 50-150 |
| 13C2_8:2FTS | | 122 | 50-150 |
| 13C2_PFDoA | | 108 | 50-150 |
| 13C2_PFTeDA | | 98 | 50-150 |
| 13C3_PFBS | | 107 | 50-150 |
| 13C3_PFHxS | | 105 | 50-150 |
| 13C4_PFBA | | 108 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 |
| 13C5_PFHxA | | 108 | 50-150 |
| 13C5_PFPeA | | 99 | 50-150 |
| 13C6_PFDA | | 97 | 50-150 |
| 13C7_PFUdA | | 107 | 50-150 |
| 13C8_PFOA | | 102 | 50-150 |
| 13C8_PFOS | | 104 | 50-150 |
| 13C8_PFOSA | | 109 | 50-150 |
| 13C9_PFNA | | 93 | 50-150 |
| d5-EtFOSAA | | 101 | 50-150 |
| d-MeFOSA | | 56 | 50-150 |
| d3-MeFOSAA | | 105 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47309-002
Batch: 47309
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/07/2022 1706

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| PFHpA | 16 | 14 | | 1 | 85 | 72-130 | 07/10/2022 1622 |
| PFPeA | 16 | 16 | | 1 | 101 | 72-129 | 07/10/2022 1622 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 |
| 13C2_6:2FTS | N | 200 | 50-150 |
| 13C2_8:2FTS | | 113 | 50-150 |
| 13C2_PFDoA | | 80 | 50-150 |
| 13C2_PFTeDA | | 90 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 |
| 13C4_PFHpA | | 96 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 |
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 116 | 50-150 |
| 13C9_PFNA | | 94 | 50-150 |
| d5-EtFOSAA | | 91 | 50-150 |
| d-MeFOSA | | 66 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCSD

Sample ID: XQ47309-003
Batch: 47309
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/07/2022 1706

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|
| PFHpA | 16 | 15 | | 1 | 91 | 7.1 | 72-130 | 30 | 07/10/2022 1632 |
| PFPeA | 16 | 15 | | 1 | 97 | 4.7 | 72-129 | 30 | 07/10/2022 1632 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 90 | 50-150 |
| 13C2_6:2FTS | N | 194 | 50-150 |
| 13C2_8:2FTS | | 99 | 50-150 |
| 13C2_PFDoA | | 80 | 50-150 |
| 13C2_PFTeDA | | 89 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 |
| 13C4_PFBA | | 94 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 89 | 50-150 |
| 13C7_PFUdA | | 97 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 |
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 |
| d-MeFOSA | | 51 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XF17015-020MS
Batch: 47309
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/07/2022 1706

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| PFHpA | 64 | 14 | 79 | | 1 | 107 | 72-130 | 07/10/2022 1704 |
| PFPeA | 71 | 14 | 84 | | 1 | 94 | 72-129 | 07/10/2022 1704 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 109 | 50-150 |
| 13C2_6:2FTS | N | 279 | 50-150 |
| 13C2_8:2FTS | | 136 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 |
| 13C2_PFTeDA | | 96 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 |
| 13C3_PFHxS | | 86 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 100 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 101 | 50-150 |
| 13C6_PFDA | | 95 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 95 | 50-150 |
| 13C8_PFOS | | 56 | 50-150 |
| 13C8_PFOSA | | 113 | 50-150 |
| 13C9_PFNA | | 59 | 50-150 |
| d5-EtFOSAA | | 96 | 50-150 |
| d-MeFOSA | | 78 | 50-150 |
| d3-MeFOSAA | | 105 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Sample ID: XF17015-020MD
Batch: 47309
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/07/2022 1706

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| PFHpA | 64 | 14 | 78 | | 1 | 101 | 0.83 | 72-130 | 30 | 07/10/2022 1715 |
| PFPeA | 71 | 14 | 87 | | 1 | 114 | 3.4 | 72-129 | 30 | 07/10/2022 1715 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 |
| 13C2_6:2FTS | N | 333 | 50-150 |
| 13C2_8:2FTS | | 115 | 50-150 |
| 13C2_PFDoA | | 82 | 50-150 |
| 13C2_PFTeDA | | 98 | 50-150 |
| 13C3_PFBS | | 102 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 |
| 13C4_PFHpA | | 105 | 50-150 |
| 13C5_PFHxA | | 102 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 |
| 13C7_PFUdA | | 104 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 |
| 13C8_PFOS | | 55 | 50-150 |
| 13C8_PFOSA | | 128 | 50-150 |
| 13C9_PFNA | | 58 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 |
| d-MeFOSA | | 77 | 50-150 |
| d3-MeFOSAA | | 105 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47402-001
Batch: 47402
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/08/2022 1216

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/11/2022 1814 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/11/2022 1814 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 123 | 50-150 |
| 13C2_6:2FTS | | 124 | 50-150 |
| 13C2_8:2FTS | | 108 | 50-150 |
| 13C2_PFDoA | | 101 | 50-150 |
| 13C2_PFTeDA | | 92 | 50-150 |
| 13C3_PFBS | | 111 | 50-150 |
| 13C3_PFHxS | | 112 | 50-150 |
| 13C4_PFBA | | 109 | 50-150 |
| 13C4_PFHpA | | 106 | 50-150 |
| 13C5_PFHxA | | 106 | 50-150 |
| 13C5_PFPeA | | 106 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 |
| 13C7_PFUdA | | 103 | 50-150 |
| 13C8_PFOA | | 109 | 50-150 |
| 13C8_PFOS | | 103 | 50-150 |
| 13C8_PFOSA | | 112 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d5-EtFOSAA | | 106 | 50-150 |
| d-MeFOSA | | 88 | 50-150 |
| d3-MeFOSAA | | 110 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47402-002
Batch: 47402
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/08/2022 1216

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| PFHpA | 16 | 16 | | 1 | 101 | 72-130 | 07/11/2022 1824 |
| PFPeA | 16 | 17 | | 1 | 108 | 72-129 | 07/11/2022 1824 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 125 | 50-150 |
| 13C2_6:2FTS | | 132 | 50-150 |
| 13C2_8:2FTS | | 111 | 50-150 |
| 13C2_PFDoA | | 103 | 50-150 |
| 13C2_PFTeDA | | 95 | 50-150 |
| 13C3_PFBS | | 109 | 50-150 |
| 13C3_PFHxS | | 111 | 50-150 |
| 13C4_PFBA | | 108 | 50-150 |
| 13C4_PFHpA | | 106 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 104 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 |
| 13C7_PFUdA | | 105 | 50-150 |
| 13C8_PFOA | | 111 | 50-150 |
| 13C8_PFOS | | 106 | 50-150 |
| 13C8_PFOSA | | 109 | 50-150 |
| 13C9_PFNA | | 100 | 50-150 |
| d5-EtFOSAA | | 110 | 50-150 |
| d-MeFOSA | | 78 | 50-150 |
| d3-MeFOSAA | | 108 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical

Cooler 1 of 2

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 135006

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: 231-534-5092/khasbrouck@tetratech.com, 720-308-5367/Craig.Divine@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x [signature] | Analysis (Attach list if more space is needed) | Page 1 of 2 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | XF17015 KER2 |
| Project Name: ESTCP Vertebrae - Grayling, MI | | | |
| Project No.: 30027244.00003 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Sample Type (G=Grab, C=Composite) | Matrix: Aqueous | Solid | Other (Specify) | No. of Containers by Preservative Type: Unpres. | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | Field Filtered | PFAS 28 USEPA Method 537 mod ISO PFAS 533 Analysis | Total Oxygen Combustion | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-D-MS_06132022 | 6/13/22 | 1240 | G | X | | | 2 | | | | | | | X | | |
| VRTB-D-06_06132022 | 6/13/22 | 1350 | G | X | | | 2 | | | | | | | X | | |
| VRTB-D-RT_06132022 | 6/13/22 | 1510 | G | X | | | 2 | | | | | | | X | | |
| VRTB-D-P8_06132022 | 6/13/22 | 1615 | G | X | | | 2 | | | | | | | X | | |
| Dup-01_06132022 | 6/13/22 | ---- | G | X | | | 2 | | | | | | | X | | |
| VRTB-S-B1_06132022 | 6/13/22 | 1730 | G | X | | | 2 | | | | | | | X | | |
| VRTB-S-S2_06132022 | 6/13/22 | 1825 | G | X | | | 2 | | | | | | | X | | |
| VRTB-S-Y3_06132022 | 6/13/22 | 1905 | G | X | | | 2 | | | | | | | X | | |
| VRTB-S-GH_06132022 | 6/13/22 | 1945 | G | X | | | 2 | | | | | | | X | | |
| VRTB-L-B1_06142022 | 6/14/22 | 0910 | G | X | | | 2 | | | | | | | X | | |

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client ☒ Disposal by Lab

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

| | Date | Time |
|---|---|---|
| 1. Relinquished by: [signature]/Austin Westhuis/Arcadis | 6/16/22 | |
| 2. Relinquished by | | |
| 3. Relinquished by | | |
| 4. Relinquished by: FedEx | 6-17-22 | 0955 |

| | Date | Time |
|---|---|---|
| 1. Received by: FedEx | 6/16/22 | |
| 2. Received by | | |
| 3. Received by | | |
| 4. Laboratory Received by: [signature] | 6-17-22 | 0955 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle): (Yes) No Ice Pack
Receipt Temp: 3.1 °C
Temp Blank: Y/N ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

* Level II Package Required

Document Number: MF003N2-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

Cooler 1 of 2

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 135099

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: 231-534-6092 / khasbrouck@tetratech.com; 720-308-5267 / Craig.Divine@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x Austin Westhuis | Analysis (Attach list if more space is needed) | Page 2 of 2 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | XF17015 |
| Project Name: ESTCP Vertebrae - Grayling, MI | | | Remarks / Cooler I.D. |
| Project No.: 30027244.00003 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | G=Grab C=Composite | Matrix: Aqueous | Solid | Wipe/Swab | No. of Containers by Preservative Type: Unpres. | HCl | HNO3 | H2SO4 | NaOH | Na2S2O3 | Methanol | PFAS 36 (USEPA Method 537 w/isotope dilution per QSM 5.3 Table B-15) | Total Organic Carbon | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-L-BB8_06142022 | 6/14/22 | 1630 | G | X | | | 2 | | | | | | | X | | |
| VRTB-L-P7_06142022 | 6/14/22 | 1545 | G | X | | | 2 | | | | | | | X | | |
| VRTB-L-06_06142022 | 6/14/22 | 1435 | G | X | | | 2 | | | | | | | X | | |
| VRTB-L-M5_06142022 | 6/14/22 | 1340 | G | X | | | 2 | | | | | | | X | | |
| VRTB-L-G4_06142022 | 6/14/22 | 1205 | G | X | | | 2 | | | | | | | X | | |
| VRTB-L-Y3_06142022 | 6/14/22 | 1115 | G | X | | | 2 | | | | | | | X | | |
| ~~VRTB-L-S2_06142022~~ | ~~6/14/22~~ | ~~1025~~ | ~~G~~ | ~~X~~ | | | ~~2~~ | | | | | | | ~~X~~ | | |
| Dup-02_06142022 | 6/14/22 | ——— | G | X | | | 2 | | | | | | | X | | |
| MW-VRTB-2D_06142022 | 6/14/22 | 1740 | G | X | | | 2 | | | | | | | X | | |
| MW-VRTB-2S_06142022 | 6/14/22 | 1815 | G | X | | | 6 | | | | | | | X | | ms/msD |

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client ☒ Disposal by Lab

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

| | | | | | |
|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | Date: 6/16/22 | Time: | 1. Received by: Fed Ex | Date: 6/16/22 | Time: |
| 2. Relinquished by | Date: | Time: | 2. Received by | Date: | Time: |
| 3. Relinquished by | Date: | Time: | 3. Received by | Date: | Time: |
| 4. Relinquished by: FedEx | Date: 6-17-22 | Time: 0955 | 4. Laboratory received by | Date: 6-17-22 | Time: 0955 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on Ice (Circle) (Yes) No; Ice Pack; Receipt Temp: 3.1 °C; Temp Blank: ☒ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

* Level II Package Required

Document Number: ME003N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/28/2020
Page 1 of 1

# Sample Receipt Checklist (SRC)

Client: Arcadis  Cooler Inspected by/date: TEC / 06/17/2022  Lot #: XF17015

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No | ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: NA

3.1 / 3.1 °C  NA / NA °C  NA / NA °C  NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles  IR Gun ID: 6  IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☐ Yes | ☐ No | ☑ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☐ Yes | ☐ No | ☑ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☐ Yes | ☑ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS? |
| ☑ Yes | ☐ No | | 21. Was the quote number listed on the container label? If yes, Quote # 25221 |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: $H_2SO_4$, $HNO_3$, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: TEC  Date: 06/17/2022

Comments:

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP Vertebrae

Project Number: 30027244.00001

Lot Number:**XF17016**

Date Completed:08/11/2022

08/14/2022 5:20 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: XF17016

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples were compliant with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

For samples XF17016-002, XF17016-003, XF17016-005, XF17016-016 sample matrix prevented full volume from being extracted, precluding method mandated bottle rinse. Elution solvent was aliquoted directly into the reservoir, rinsing the inside. Surrogate recovery may be adversely affected.

The following samples were re-prepared outside of preparation holding time due to PFPeA method blank contamination in the initial, in hold run: XF17016-001, XF17016-002, XF17016-003, XF17016-005, XF17016-010, XF17016-012, XF17016-013, XF17016-014, XF17016-018. All data has been reported.

Surrogate recovery for the following sample was outside control limits: XF17016-004. Re-extraction and/or re-analysis was performed with concurring results. The original analysis has been reported.

Surrogate recovery for the following sample was outside control limits: XF17016-007, XF17016-009, XF17016-011, XF17016-015. Re-extraction and/or re-analysis was performed and all data has been reported.

Surrogate recovery for the following samples was outside control limits: XF17016-017. Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: XF17016

Project Name: ESTCP Vertebrae

Project Number: 30027244.00001

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | MW-VRTB-3_06142022 | Aqueous | 06/14/2022 1910 | 06/17/2022 |
| 002 | VRTB-D-B1_06152022 | Aqueous | 06/14/2022 1025 | 06/17/2022 |
| 003 | VRTB-D-S2_06152022 | Aqueous | 06/14/2022 1105 | 06/17/2022 |
| 004 | VRTB-D-Y3_06152022 | Aqueous | 06/14/2022 1150 | 06/17/2022 |
| 005 | VRTB-D-G4_06152022 | Aqueous | 06/14/2022 1305 | 06/17/2022 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | 06/14/2022 1350 | 06/17/2022 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | 06/14/2022 1425 | 06/17/2022 |
| 008 | CMT-VRTB-01_1_06152022 | Aqueous | 06/14/2022 1525 | 06/17/2022 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | 06/14/2022 1610 | 06/17/2022 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | 06/14/2022 1650 | 06/17/2022 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | 06/14/2022 1725 | 06/17/2022 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | 06/14/2022 1810 | 06/17/2022 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | 06/14/2022 1845 | 06/17/2022 |
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | 06/14/2022 1910 | 06/17/2022 |
| 015 | VRTB-S-M5_06162022 | Aqueous | 06/14/2022 0905 | 06/17/2022 |
| 016 | VRTB-S-06_06162022 | Aqueous | 06/14/2022 1025 | 06/17/2022 |
| 017 | VRTB-S-R7_06162022 | Aqueous | 06/14/2022 1120 | 06/17/2022 |
| 018 | VRTB-S-P8_06162022 | Aqueous | 06/14/2022 1215 | 06/17/2022 |

(18 samples)

# Detection Summary

## Arcadis U.S., Inc.

Lot Number: XF17016

Project Name: ESTCP Vertebrae

Project Number: 30027244.00001

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | MW-VRTB-3_06142022 | Aqueous | PFBS | PFAS by ID | 1.9 | J | ng/L | 22 |
| 001 | MW-VRTB-3_06142022 | Aqueous | PFHpS | PFAS by ID | 2.1 | J | ng/L | 22 |
| 001 | MW-VRTB-3_06142022 | Aqueous | PFPeS | PFAS by ID | 3.1 | J | ng/L | 22 |
| 001 | MW-VRTB-3_06142022 | Aqueous | PFHxS | PFAS by ID | 39 | | ng/L | 22 |
| 001 | MW-VRTB-3_06142022 | Aqueous | PFBA | PFAS by ID | 5.5 | B | ng/L | 22 |
| 001 | MW-VRTB-3_06142022 | Aqueous | PFHpA | PFAS by ID | 1.5 | J | ng/L | 22 |
| 001 | MW-VRTB-3_06142022 | Aqueous | PFHxA | PFAS by ID | 3.4 | J | ng/L | 22 |
| 001 | MW-VRTB-3_06142022 | Aqueous | PFOA | PFAS by ID | 2.1 | J | ng/L | 22 |
| 001 | MW-VRTB-3_06142022 | Aqueous | PFOS | PFAS by ID | 30 | | ng/L | 22 |
| 002 | VRTB-D-B1_06152022 | Aqueous | 8:2 FTS | PFAS by ID | 3.0 | J | ng/L | 26 |
| 002 | VRTB-D-B1_06152022 | Aqueous | 6:2 FTS | PFAS by ID | 4.1 | J | ng/L | 26 |
| 002 | VRTB-D-B1_06152022 | Aqueous | PFBS | PFAS by ID | 14 | | ng/L | 26 |
| 002 | VRTB-D-B1_06152022 | Aqueous | PFHpS | PFAS by ID | 17 | | ng/L | 26 |
| 002 | VRTB-D-B1_06152022 | Aqueous | PFPeS | PFAS by ID | 19 | | ng/L | 26 |
| 002 | VRTB-D-B1_06152022 | Aqueous | PFHxS | PFAS by ID | 350 | | ng/L | 26 |
| 002 | VRTB-D-B1_06152022 | Aqueous | PFBA | PFAS by ID | 24 | B | ng/L | 26 |
| 002 | VRTB-D-B1_06152022 | Aqueous | PFHpA | PFAS by ID | 18 | | ng/L | 26 |
| 002 | VRTB-D-B1_06152022 | Aqueous | PFHxA | PFAS by ID | 43 | | ng/L | 26 |
| 002 | VRTB-D-B1_06152022 | Aqueous | PFNA | PFAS by ID | 6.6 | | ng/L | 26 |
| 002 | VRTB-D-B1_06152022 | Aqueous | PFOA | PFAS by ID | 40 | | ng/L | 26 |
| 002 | VRTB-D-B1_06152022 | Aqueous | PFOS | PFAS by ID | 1600 | | ng/L | 28 |
| 002 | VRTB-D-B1_06152022 | Aqueous | PFPeA | PFAS by ID | 36 | H | ng/L | 30 |
| 003 | VRTB-D-S2_06152022 | Aqueous | PFBS | PFAS by ID | 19 | | ng/L | 32 |
| 003 | VRTB-D-S2_06152022 | Aqueous | PFHpS | PFAS by ID | 7.6 | | ng/L | 32 |
| 003 | VRTB-D-S2_06152022 | Aqueous | PFPeS | PFAS by ID | 33 | | ng/L | 32 |
| 003 | VRTB-D-S2_06152022 | Aqueous | PFHxS | PFAS by ID | 200 | | ng/L | 32 |
| 003 | VRTB-D-S2_06152022 | Aqueous | PFBA | PFAS by ID | 9.8 | B | ng/L | 32 |
| 003 | VRTB-D-S2_06152022 | Aqueous | PFHpA | PFAS by ID | 9.1 | | ng/L | 32 |
| 003 | VRTB-D-S2_06152022 | Aqueous | PFHxA | PFAS by ID | 19 | | ng/L | 32 |
| 003 | VRTB-D-S2_06152022 | Aqueous | PFNA | PFAS by ID | 2.2 | J | ng/L | 32 |
| 003 | VRTB-D-S2_06152022 | Aqueous | PFOA | PFAS by ID | 23 | | ng/L | 32 |
| 003 | VRTB-D-S2_06152022 | Aqueous | PFOS | PFAS by ID | 350 | | ng/L | 34 |
| 003 | VRTB-D-S2_06152022 | Aqueous | PFPeA | PFAS by ID | 16 | H | ng/L | 36 |
| 004 | VRTB-D-Y3_06152022 | Aqueous | PFBS | PFAS by ID | 3.4 | | ng/L | 38 |
| 004 | VRTB-D-Y3_06152022 | Aqueous | PFHpS | PFAS by ID | 1.9 | JQ | ng/L | 38 |
| 004 | VRTB-D-Y3_06152022 | Aqueous | PFPeS | PFAS by ID | 5.6 | | ng/L | 38 |
| 004 | VRTB-D-Y3_06152022 | Aqueous | PFHxS | PFAS by ID | 70 | Q | ng/L | 38 |
| 004 | VRTB-D-Y3_06152022 | Aqueous | PFBA | PFAS by ID | 5.1 | B | ng/L | 38 |
| 004 | VRTB-D-Y3_06152022 | Aqueous | PFHpA | PFAS by ID | 3.2 | J | ng/L | 38 |
| 004 | VRTB-D-Y3_06152022 | Aqueous | PFHxA | PFAS by ID | 4.4 | | ng/L | 38 |
| 004 | VRTB-D-Y3_06152022 | Aqueous | PFOA | PFAS by ID | 5.8 | | ng/L | 38 |
| 004 | VRTB-D-Y3_06152022 | Aqueous | PFPeA | PFAS by ID | 3.3 | J | ng/L | 38 |
| 004 | VRTB-D-Y3_06152022 | Aqueous | PFOS | PFAS by ID | 170 | Q | ng/L | 38 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 005 | VRTB-D-G4_06152022 | Aqueous | PFBS | PFAS by ID | 1.7 | J | ng/L | 40 |
| 005 | VRTB-D-G4_06152022 | Aqueous | PFHpS | PFAS by ID | 1.8 | J | ng/L | 40 |
| 005 | VRTB-D-G4_06152022 | Aqueous | PFOSA | PFAS by ID | 1.2 | J | ng/L | 40 |
| 005 | VRTB-D-G4_06152022 | Aqueous | PFPeS | PFAS by ID | 2.6 | J | ng/L | 40 |
| 005 | VRTB-D-G4_06152022 | Aqueous | PFHxS | PFAS by ID | 50 | | ng/L | 40 |
| 005 | VRTB-D-G4_06152022 | Aqueous | PFBA | PFAS by ID | 9.2 | B | ng/L | 40 |
| 005 | VRTB-D-G4_06152022 | Aqueous | PFHpA | PFAS by ID | 4.8 | | ng/L | 40 |
| 005 | VRTB-D-G4_06152022 | Aqueous | PFHxA | PFAS by ID | 16 | | ng/L | 40 |
| 005 | VRTB-D-G4_06152022 | Aqueous | PFOA | PFAS by ID | 3.8 | | ng/L | 40 |
| 005 | VRTB-D-G4_06152022 | Aqueous | PFOS | PFAS by ID | 99 | | ng/L | 40 |
| 005 | VRTB-D-G4_06152022 | Aqueous | PFPeA | PFAS by ID | 22 | H | ng/L | 42 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | PFBS | PFAS by ID | 9.5 | | ng/L | 44 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | PFHpS | PFAS by ID | 6.5 | | ng/L | 44 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | PFPeS | PFAS by ID | 12 | | ng/L | 44 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | PFHxS | PFAS by ID | 190 | | ng/L | 44 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | PFBA | PFAS by ID | 13 | B | ng/L | 44 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | PFHpA | PFAS by ID | 12 | | ng/L | 44 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | PFHxA | PFAS by ID | 22 | | ng/L | 44 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | PFNA | PFAS by ID | 0.89 | J | ng/L | 44 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | PFOA | PFAS by ID | 17 | | ng/L | 44 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | PFPeA | PFAS by ID | 20 | B | ng/L | 44 |
| 006 | MW-VRTB-1D_06152022 | Aqueous | PFOS | PFAS by ID | 180 | | ng/L | 44 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | 8:2 FTS | PFAS by ID | 52 | | ng/L | 46 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | 6:2 FTS | PFAS by ID | 150 | | ng/L | 46 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | PFBS | PFAS by ID | 19 | | ng/L | 46 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | PFHpS | PFAS by ID | 120 | | ng/L | 46 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | PFPeS | PFAS by ID | 43 | | ng/L | 46 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | PFBA | PFAS by ID | 76 | B | ng/L | 46 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | PFHpA | PFAS by ID | 160 | | ng/L | 46 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | PFHxA | PFAS by ID | 250 | | ng/L | 46 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | PFNA | PFAS by ID | 72 | Q | ng/L | 46 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | PFOA | PFAS by ID | 300 | | ng/L | 46 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | PFPeA | PFAS by ID | 190 | B | ng/L | 46 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | PFHxS | PFAS by ID | 1900 | H | ng/L | 48 |
| 007 | MW-VRTB-1S_06152022 | Aqueous | PFOS | PFAS by ID | 13000 | H | ng/L | 48 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | 8:2 FTS | PFAS by ID | 54 | | ng/L | 52 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | 6:2 FTS | PFAS by ID | 100 | | ng/L | 52 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFBS | PFAS by ID | 50 | | ng/L | 52 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFHpS | PFAS by ID | 230 | | ng/L | 52 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFOSA | PFAS by ID | 0.88 | J | ng/L | 52 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFPeS | PFAS by ID | 120 | | ng/L | 52 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFBA | PFAS by ID | 48 | B | ng/L | 52 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFHpA | PFAS by ID | 130 | | ng/L | 52 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFHxA | PFAS by ID | 330 | | ng/L | 52 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFOA | PFAS by ID | 240 | | ng/L | 52 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFPeA | PFAS by ID | 130 | B | ng/L | 52 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFNA | PFAS by ID | 77 | H | ng/L | 54 |
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFHxS | PFAS by ID | 3500 | H | ng/L | 56 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 009 | CMT-VRTB-01_2_06152022 | Aqueous | PFOS | PFAS by ID | 33000 | H | ng/L | 56 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | PFBS | PFAS by ID | 17 | | ng/L | 58 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | PFHpS | PFAS by ID | 18 | | ng/L | 58 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | PFPeS | PFAS by ID | 30 | | ng/L | 58 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | PFBA | PFAS by ID | 43 | B | ng/L | 58 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | PFHpA | PFAS by ID | 72 | | ng/L | 58 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | PFHxA | PFAS by ID | 160 | | ng/L | 58 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | PFNA | PFAS by ID | 16 | | ng/L | 58 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | PFOA | PFAS by ID | 58 | | ng/L | 58 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | PFPeA | PFAS by ID | 98 | B | ng/L | 58 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | PFHxS | PFAS by ID | 730 | H | ng/L | 60 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | PFOS | PFAS by ID | 2300 | H | ng/L | 60 |
| 010 | CMT-VRTB-01_3_06152022 | Aqueous | 6:2 FTS | PFAS by ID | 17 | | ng/L | 62 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | 6:2 FTS | PFAS by ID | 1.7 | J | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFBS | PFAS by ID | 11 | | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFHpS | PFAS by ID | 9.3 | | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFOSA | PFAS by ID | 0.92 | J | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFPeS | PFAS by ID | 15 | | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFHxS | PFAS by ID | 280 | | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFBA | PFAS by ID | 15 | B | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFHpA | PFAS by ID | 15 | | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFHxA | PFAS by ID | 30 | | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFNA | PFAS by ID | 4.9 | | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFOA | PFAS by ID | 29 | | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFPeA | PFAS by ID | 21 | | ng/L | 64 |
| 011 | CMT-VRTB-01_4_06152022 | Aqueous | PFOS | PFAS by ID | 730 | Q | ng/L | 64 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | PFBS | PFAS by ID | 9.3 | H | ng/L | 68 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | PFHpS | PFAS by ID | 4.7 | H | ng/L | 68 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | PFPeS | PFAS by ID | 12 | H | ng/L | 68 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | PFHxS | PFAS by ID | 190 | H | ng/L | 68 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | PFBA | PFAS by ID | 10 | H | ng/L | 68 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | PFHpA | PFAS by ID | 12 | H | ng/L | 68 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | PFHxA | PFAS by ID | 21 | H | ng/L | 68 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | PFNA | PFAS by ID | 1.2 | HJ | ng/L | 68 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | PFOA | PFAS by ID | 21 | H | ng/L | 68 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | PFPeA | PFAS by ID | 16 | H | ng/L | 68 |
| 012 | CMT-VRTB-01_5_06152022 | Aqueous | PFOS | PFAS by ID | 99 | H | ng/L | 68 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | PFBS | PFAS by ID | 10 | | ng/L | 70 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | PFHpS | PFAS by ID | 7.2 | | ng/L | 70 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | PFOSA | PFAS by ID | 1.5 | J | ng/L | 70 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | PFPeS | PFAS by ID | 17 | | ng/L | 70 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | PFHxS | PFAS by ID | 220 | | ng/L | 70 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | PFBA | PFAS by ID | 16 | | ng/L | 70 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | PFHpA | PFAS by ID | 12 | | ng/L | 70 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | PFHxA | PFAS by ID | 28 | | ng/L | 70 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | PFOA | PFAS by ID | 22 | | ng/L | 70 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | PFOS | PFAS by ID | 120 | | ng/L | 70 |
| 013 | CMT-VRTB-01_6_06152022 | Aqueous | PFPeA | PFAS by ID | 20 | H | ng/L | 72 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | PFBS | PFAS by ID | 6.1 | | ng/L | 74 |
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | PFHpS | PFAS by ID | 8.0 | | ng/L | 74 |
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | PFPeS | PFAS by ID | 5.4 | | ng/L | 74 |
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | PFHxS | PFAS by ID | 160 | | ng/L | 74 |
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | PFBA | PFAS by ID | 8.6 | | ng/L | 74 |
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | PFHpA | PFAS by ID | 8.3 | | ng/L | 74 |
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | PFHxA | PFAS by ID | 13 | | ng/L | 74 |
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | PFNA | PFAS by ID | 7.5 | | ng/L | 74 |
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | PFOA | PFAS by ID | 17 | | ng/L | 74 |
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | PFOS | PFAS by ID | 660 | | ng/L | 76 |
| 014 | CMT-VRTB-01_7_06152022 | Aqueous | PFPeA | PFAS by ID | 6.6 | H | ng/L | 78 |
| 015 | VRTB-S-M5_06162022 | Aqueous | 8:2 FTS | PFAS by ID | 5.5 | J | ng/L | 80 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFBS | PFAS by ID | 6.0 | | ng/L | 80 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFHpS | PFAS by ID | 17 | | ng/L | 80 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFOSA | PFAS by ID | 3.1 | J | ng/L | 80 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFPeS | PFAS by ID | 9.7 | | ng/L | 80 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFBA | PFAS by ID | 25 | | ng/L | 80 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFHpA | PFAS by ID | 39 | | ng/L | 80 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFHxA | PFAS by ID | 58 | | ng/L | 80 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFNA | PFAS by ID | 10 | | ng/L | 80 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFOA | PFAS by ID | 46 | | ng/L | 80 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFPeA | PFAS by ID | 57 | B | ng/L | 80 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFHxS | PFAS by ID | 330 | | ng/L | 82 |
| 015 | VRTB-S-M5_06162022 | Aqueous | PFOS | PFAS by ID | 2400 | | ng/L | 82 |
| 015 | VRTB-S-M5_06162022 | Aqueous | 6:2 FTS | PFAS by ID | 19 | H | ng/L | 84 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFBS | PFAS by ID | 17 | | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFHpS | PFAS by ID | 29 | | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFOSA | PFAS by ID | 3.6 | | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFPeS | PFAS by ID | 34 | | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFHxS | PFAS by ID | 520 | | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFBA | PFAS by ID | 15 | | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFDA | PFAS by ID | 0.97 | J | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFHpA | PFAS by ID | 25 | | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFHxA | PFAS by ID | 46 | | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFNA | PFAS by ID | 8.0 | | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFOA | PFAS by ID | 40 | | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFPeA | PFAS by ID | 23 | B | ng/L | 86 |
| 016 | VRTB-S-06_06162022 | Aqueous | PFOS | PFAS by ID | 1900 | | ng/L | 86 |
| 017 | VRTB-S-R7_06162022 | Aqueous | 8:2 FTS | PFAS by ID | 37 | | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | 6:2 FTS | PFAS by ID | 89 | | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | PFBS | PFAS by ID | 44 | | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | PFHpS | PFAS by ID | 140 | | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | PFOSA | PFAS by ID | 1.0 | J | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | PFPeS | PFAS by ID | 89 | | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | PFHxS | PFAS by ID | 1900 | | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | PFBA | PFAS by ID | 62 | | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | PFHpA | PFAS by ID | 150 | | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | PFHxA | PFAS by ID | 310 | | ng/L | 88 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 017 | VRTB-S-R7_06162022 | Aqueous | PFNA | PFAS by ID | 76 | Q | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | PFOA | PFAS by ID | 230 | | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | PFPeA | PFAS by ID | 150 | B | ng/L | 88 |
| 017 | VRTB-S-R7_06162022 | Aqueous | PFOS | PFAS by ID | 16000 | | ng/L | 88 |
| 018 | VRTB-S-P8_06162022 | Aqueous | 8:2 FTS | PFAS by ID | 6.5 | J | ng/L | 90 |
| 018 | VRTB-S-P8_06162022 | Aqueous | 6:2 FTS | PFAS by ID | 21 | | ng/L | 90 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFBS | PFAS by ID | 17 | | ng/L | 90 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFHpS | PFAS by ID | 63 | | ng/L | 90 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFOSA | PFAS by ID | 1.3 | J | ng/L | 90 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFPeS | PFAS by ID | 32 | | ng/L | 90 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFHpA | PFAS by ID | 32 | | ng/L | 90 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFHxA | PFAS by ID | 96 | | ng/L | 90 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFNA | PFAS by ID | 22 | | ng/L | 90 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFOA | PFAS by ID | 64 | | ng/L | 90 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFPeA | PFAS by ID | 34 | B | ng/L | 90 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFHxS | PFAS by ID | 720 | | ng/L | 92 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFOS | PFAS by ID | 7300 | | ng/L | 92 |
| 018 | VRTB-S-P8_06162022 | Aqueous | PFBA | PFAS by ID | 22 | H | ng/L | 94 |

(205 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-001
Description: MW-VRTB-3_06142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1910 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 1955 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/25/2022 2118 | MMM | 07/05/2022 0909 | 47070 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.9 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.1 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 3.1 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 39 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 5.5 | B | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 1.5 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 3.4 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 2.1 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 4.0 | B | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 30 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 102 | 50-150 | H | 106 | 50-150 |
| 13C2_6:2FTS | | 126 | 50-150 | H | 148 | 50-150 |
| 13C2_8:2FTS | | 70 | 50-150 | H | 87 | 50-150 |
| 13C2_PFDoA | | 59 | 50-150 | H | 103 | 50-150 |
| 13C2_PFTeDA | | 54 | 50-150 | H | 105 | 50-150 |
| 13C3_PFBS | | 75 | 50-150 | H | 102 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | | 90 | 50-150 | H | 101 | 50-150 |
| 13C4_PFHpA | | 84 | 50-150 | H | 100 | 50-150 |
| 13C5_PFHxA | | 79 | 50-150 | H | 109 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 | H | 107 | 50-150 |
| 13C6_PFDA | | 105 | 50-150 | H | 109 | 50-150 |
| 13C7_PFUdA | | 81 | 50-150 | H | 96 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 | H | 107 | 50-150 |
| 13C8_PFOS | | 88 | 50-150 | H | 103 | 50-150 |
| 13C8_PFOSA | | 112 | 50-150 | H | 107 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-001
Description: MW-VRTB-3_06142022
Matrix: Aqueous
Date Sampled: 06/14/2022 1910
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | H | 104 | 50-150 |
| d5-EtFOSAA | | 66 | 50-150 | H | 94 | 50-150 |
| d-MeFOSA | | 56 | 50-150 | H | 84 | 50-150 |
| d3-MeFOSAA | | 75 | 50-150 | H | 110 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-001
Description: MW-VRTB-3_06142022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1910 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 1955 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/25/2022 2118 | MMM | 07/05/2022 0909 | 47070 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.6 | UH | 7.2 | 3.6 | 1.8 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.6 | UH | 7.2 | 3.6 | 1.8 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.6 | UH | 7.2 | 3.6 | 1.8 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | UH | 7.2 | 3.6 | 1.8 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.6 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | UH | 7.2 | 3.6 | 1.8 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 36 | H | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 3.9 | BH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 25 | H | 3.6 | 1.8 | 0.90 | ng/L | 2 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 102 | 50-150 | H | 106 | 50-150 |
| 13C2_6:2FTS | | 126 | 50-150 | H | 148 | 50-150 |
| 13C2_8:2FTS | | 70 | 50-150 | H | 87 | 50-150 |
| 13C2_PFDoA | | 59 | 50-150 | H | 103 | 50-150 |
| 13C2_PFTeDA | | 54 | 50-150 | H | 105 | 50-150 |
| 13C3_PFBS | | 75 | 50-150 | H | 102 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | | 90 | 50-150 | H | 101 | 50-150 |
| 13C4_PFHpA | | 84 | 50-150 | H | 100 | 50-150 |
| 13C5_PFHxA | | 79 | 50-150 | H | 109 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 | H | 107 | 50-150 |
| 13C6_PFDA | | 105 | 50-150 | H | 109 | 50-150 |
| 13C7_PFUdA | | 81 | 50-150 | H | 96 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 | H | 107 | 50-150 |
| 13C8_PFOS | | 88 | 50-150 | H | 103 | 50-150 |
| 13C8_PFOSA | | 112 | 50-150 | H | 107 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-001
Description: MW-VRTB-3_06142022
Matrix: Aqueous
Date Sampled: 06/14/2022 1910
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | H | 104 | 50-150 |
| d5-EtFOSAA | | 66 | 50-150 | H | 94 | 50-150 |
| d-MeFOSA | | 56 | 50-150 | H | 84 | 50-150 |
| d3-MeFOSAA | | 75 | 50-150 | H | 110 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-002
Description: VRTB-D-B1_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1025 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2006 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 07/29/2022 1147 | LAB | 07/05/2022 0909 | 47070 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/27/2022 2321 | MMM | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.0 | J | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.1 | J | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.0 | U | 16 | 8.0 | 4.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.1 | U | 8.2 | 4.1 | 2.1 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 14 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 17 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 19 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 350 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 24 | B | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 18 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 43 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 6.6 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 40 | | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 35 | B | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.1 | UQ | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.1 | U | 4.1 | 2.1 | 1.0 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1500 | E | 4.1 | 2.1 | 1.0 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 101 | 50-150 | | 100 | 50-150 | H | 121 | 50-150 |
| 13C2_6:2FTS | | 116 | 50-150 | | 88 | 50-150 | H | 115 | 50-150 |
| 13C2_8:2FTS | | 91 | 50-150 | | 106 | 50-150 | H | 103 | 50-150 |
| 13C2_PFDoA | | 58 | 50-150 | | 68 | 50-150 | H | 67 | 50-150 |
| 13C2_PFTeDA | N | 39 | 50-150 | N | 44 | 50-150 | HN | 42 | 50-150 |
| 13C3_PFBS | | 77 | 50-150 | | 91 | 50-150 | H | 81 | 50-150 |
| 13C3_PFHxS | | 72 | 50-150 | | 98 | 50-150 | H | 81 | 50-150 |
| 13C4_PFBA | | 64 | 50-150 | | 78 | 50-150 | H | 65 | 50-150 |
| 13C4_PFHpA | | 78 | 50-150 | | 95 | 50-150 | H | 80 | 50-150 |
| 13C5_PFHxA | | 73 | 50-150 | | 91 | 50-150 | H | 83 | 50-150 |
| 13C5_PFPeA | | 78 | 50-150 | | 95 | 50-150 | H | 73 | 50-150 |
| 13C6_PFDA | | 77 | 50-150 | | 87 | 50-150 | H | 78 | 50-150 |
| 13C7_PFUdA | | 78 | 50-150 | | 80 | 50-150 | H | 73 | 50-150 |
| 13C8_PFOA | | 77 | 50-150 | | 90 | 50-150 | H | 81 | 50-150 |
| 13C8_PFOS | | 75 | 50-150 | | 87 | 50-150 | H | 78 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-002
Description: VRTB-D-B1_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1025
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 88 | 50-150 | | 87 | 50-150 | H | 85 | 50-150 |
| 13C9_PFNA | | 75 | 50-150 | | 86 | 50-150 | H | 75 | 50-150 |
| d5-EtFOSAA | | 62 | 50-150 | | 77 | 50-150 | H | 72 | 50-150 |
| d-MeFOSA | | 65 | 50-150 | | 76 | 50-150 | H | 76 | 50-150 |
| d3-MeFOSAA | | 78 | 50-150 | | 86 | 50-150 | H | 89 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-002
Description: VRTB-D-B1_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1025 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2006 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 07/29/2022 1147 | LAB | 07/05/2022 0909 | 47070 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/27/2022 2321 | MMM | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 41 | U | 82 | 41 | 21 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 41 | U | 82 | 41 | 21 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 41 | U | 82 | 41 | 21 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 41 | U | 82 | 41 | 21 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 80 | U | 160 | 80 | 41 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 41 | U | 82 | 41 | 21 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 16 | J | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 21 | U | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 14 | J | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 21 | U | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 21 | U | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 24 | J | 41 | 21 | 10 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 320 | | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 25 | BJ | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 21 | U | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 21 | U | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 23 | J | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 43 | | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 21 | U | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 41 | | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 40 | BJ | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 21 | UQ | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 21 | U | 41 | 21 | 10 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 21 | U | 41 | 21 | 10 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1600 | | 41 | 21 | 10 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 101 | 50-150 | | 100 | 50-150 | H | 121 | 50-150 |
| 13C2_6:2FTS | | 116 | 50-150 | | 88 | 50-150 | H | 115 | 50-150 |
| 13C2_8:2FTS | | 91 | 50-150 | | 106 | 50-150 | H | 103 | 50-150 |
| 13C2_PFDoA | | 58 | 50-150 | | 68 | 50-150 | H | 67 | 50-150 |
| 13C2_PFTeDA | N | 39 | 50-150 | N | 44 | 50-150 | HN | 42 | 50-150 |
| 13C3_PFBS | | 77 | 50-150 | | 91 | 50-150 | H | 81 | 50-150 |
| 13C3_PFHxS | | 72 | 50-150 | | 98 | 50-150 | H | 81 | 50-150 |
| 13C4_PFBA | | 64 | 50-150 | | 78 | 50-150 | H | 65 | 50-150 |
| 13C4_PFHpA | | 78 | 50-150 | | 95 | 50-150 | H | 80 | 50-150 |
| 13C5_PFHxA | | 73 | 50-150 | | 91 | 50-150 | H | 83 | 50-150 |
| 13C5_PFPeA | | 78 | 50-150 | | 95 | 50-150 | H | 73 | 50-150 |
| 13C6_PFDA | | 77 | 50-150 | | 87 | 50-150 | H | 78 | 50-150 |
| 13C7_PFUdA | | 78 | 50-150 | | 80 | 50-150 | H | 73 | 50-150 |
| 13C8_PFOA | | 77 | 50-150 | | 90 | 50-150 | H | 81 | 50-150 |
| 13C8_PFOS | | 75 | 50-150 | | 87 | 50-150 | H | 78 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-002
Description: VRTB-D-B1_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1025
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 88 | 50-150 | | 87 | 50-150 | H | 85 | 50-150 |
| 13C9_PFNA | | 75 | 50-150 | | 86 | 50-150 | H | 75 | 50-150 |
| d5-EtFOSAA | | 62 | 50-150 | | 77 | 50-150 | H | 72 | 50-150 |
| d-MeFOSA | | 65 | 50-150 | | 76 | 50-150 | H | 76 | 50-150 |
| d3-MeFOSAA | | 78 | 50-150 | | 86 | 50-150 | H | 89 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-002
Description: VRTB-D-B1_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1025 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2006 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 07/29/2022 1147 | LAB | 07/05/2022 0909 | 47070 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/27/2022 2321 | MMM | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.8 | HJ | 7.0 | 3.5 | 1.7 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.9 | HJ | 7.0 | 3.5 | 1.7 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | UH | 7.0 | 3.5 | 1.7 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | UH | 7.0 | 3.5 | 1.7 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.5 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | UH | 7.0 | 3.5 | 1.7 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 13 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 12 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 19 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 300 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 21 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 19 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 37 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 6.4 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 35 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 36 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UHQ | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1300 | HE | 3.5 | 1.8 | 0.87 | ng/L | 3 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 101 | 50-150 | | 100 | 50-150 | H | 121 | 50-150 |
| 13C2_6:2FTS | | 116 | 50-150 | | 88 | 50-150 | H | 115 | 50-150 |
| 13C2_8:2FTS | | 91 | 50-150 | | 106 | 50-150 | H | 103 | 50-150 |
| 13C2_PFDoA | | 58 | 50-150 | | 68 | 50-150 | H | 67 | 50-150 |
| 13C2_PFTeDA | N | 39 | 50-150 | N | 44 | 50-150 | HN | 42 | 50-150 |
| 13C3_PFBS | | 77 | 50-150 | | 91 | 50-150 | H | 81 | 50-150 |
| 13C3_PFHxS | | 72 | 50-150 | | 98 | 50-150 | H | 81 | 50-150 |
| 13C4_PFBA | | 64 | 50-150 | | 78 | 50-150 | H | 65 | 50-150 |
| 13C4_PFHpA | | 78 | 50-150 | | 95 | 50-150 | H | 80 | 50-150 |
| 13C5_PFHxA | | 73 | 50-150 | | 91 | 50-150 | H | 83 | 50-150 |
| 13C5_PFPeA | | 78 | 50-150 | | 95 | 50-150 | H | 73 | 50-150 |
| 13C6_PFDA | | 77 | 50-150 | | 87 | 50-150 | H | 78 | 50-150 |
| 13C7_PFUdA | | 78 | 50-150 | | 80 | 50-150 | H | 73 | 50-150 |
| 13C8_PFOA | | 77 | 50-150 | | 90 | 50-150 | H | 81 | 50-150 |
| 13C8_PFOS | | 75 | 50-150 | | 87 | 50-150 | H | 78 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-002
Description: VRTB-D-B1_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1025
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 88 | 50-150 | | 87 | 50-150 | H | 85 | 50-150 |
| 13C9_PFNA | | 75 | 50-150 | | 86 | 50-150 | H | 75 | 50-150 |
| d5-EtFOSAA | | 62 | 50-150 | | 77 | 50-150 | H | 72 | 50-150 |
| d-MeFOSA | | 65 | 50-150 | | 76 | 50-150 | H | 76 | 50-150 |
| d3-MeFOSAA | | 78 | 50-150 | | 86 | 50-150 | H | 89 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-003
Description: VRTB-D-S2_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1105 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2016 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 07/29/2022 1157 | LAB | 07/05/2022 0909 | 47070 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/27/2022 2332 | MMM | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.4 | U | 8.8 | 4.4 | 2.2 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.4 | U | 8.8 | 4.4 | 2.2 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.4 | U | 8.8 | 4.4 | 2.2 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.4 | U | 8.8 | 4.4 | 2.2 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 9.0 | UQ | 18 | 9.0 | 4.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.4 | U | 8.8 | 4.4 | 2.2 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 19 | | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.2 | U | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.6 | | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.2 | U | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.2 | U | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 33 | | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 200 | | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 9.8 | B | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.2 | U | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.2 | U | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 9.1 | | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 19 | | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.2 | J | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 23 | | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 18 | B | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.2 | UQ | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.2 | U | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.2 | U | 4.4 | 2.2 | 1.1 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 410 | E | 4.4 | 2.2 | 1.1 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 | | 97 | 50-150 | H | 136 | 50-150 |
| 13C2_6:2FTS | | 122 | 50-150 | | 103 | 50-150 | H | 121 | 50-150 |
| 13C2_8:2FTS | | 80 | 50-150 | | 98 | 50-150 | H | 100 | 50-150 |
| 13C2_PFDoA | | 56 | 50-150 | | 66 | 50-150 | H | 63 | 50-150 |
| 13C2_PFTeDA | N | 21 | 50-150 | N | 27 | 50-150 | HN | 25 | 50-150 |
| 13C3_PFBS | | 72 | 50-150 | | 92 | 50-150 | H | 78 | 50-150 |
| 13C3_PFHxS | | 70 | 50-150 | | 94 | 50-150 | H | 84 | 50-150 |
| 13C4_PFBA | | 70 | 50-150 | | 94 | 50-150 | H | 69 | 50-150 |
| 13C4_PFHpA | | 74 | 50-150 | | 94 | 50-150 | H | 81 | 50-150 |
| 13C5_PFHxA | | 70 | 50-150 | | 99 | 50-150 | H | 93 | 50-150 |
| 13C5_PFPeA | | 71 | 50-150 | | 95 | 50-150 | H | 69 | 50-150 |
| 13C6_PFDA | | 72 | 50-150 | | 91 | 50-150 | H | 75 | 50-150 |
| 13C7_PFUdA | | 72 | 50-150 | | 82 | 50-150 | H | 74 | 50-150 |
| 13C8_PFOA | | 73 | 50-150 | | 91 | 50-150 | H | 77 | 50-150 |
| 13C8_PFOS | | 76 | 50-150 | | 89 | 50-150 | H | 78 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-003
Description: VRTB-D-S2_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1105
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 81 | 50-150 | | 85 | 50-150 | H | 76 | 50-150 |
| 13C9_PFNA | | 78 | 50-150 | | 93 | 50-150 | H | 81 | 50-150 |
| d5-EtFOSAA | | 64 | 50-150 | | 71 | 50-150 | H | 66 | 50-150 |
| d-MeFOSA | N | 42 | 50-150 | N | 48 | 50-150 | H | 53 | 50-150 |
| d3-MeFOSAA | | 78 | 50-150 | | 81 | 50-150 | H | 78 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-003
Description: VRTB-D-S2_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1105 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2016 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 07/29/2022 1157 | LAB | 07/05/2022 0909 | 47070 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/27/2022 2332 | MMM | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 22 | U | 44 | 22 | 11 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 22 | U | 44 | 22 | 11 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 22 | U | 44 | 22 | 11 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 22 | U | 44 | 22 | 11 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 44 | UQ | 88 | 44 | 22 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 22 | U | 44 | 22 | 11 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 16 | J | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 11 | U | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 5.5 | J | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 11 | U | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 11 | U | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 32 | | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 150 | | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 8.0 | BJ | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 11 | U | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 11 | U | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 7.5 | J | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 14 | J | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 11 | U | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | J | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 16 | BJ | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 11 | UQ | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 11 | U | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 11 | U | 22 | 11 | 5.5 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 350 | | 22 | 11 | 5.5 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 | | 97 | 50-150 | H | 136 | 50-150 |
| 13C2_6:2FTS | | 122 | 50-150 | | 103 | 50-150 | H | 121 | 50-150 |
| 13C2_8:2FTS | | 80 | 50-150 | | 98 | 50-150 | H | 100 | 50-150 |
| 13C2_PFDoA | | 56 | 50-150 | | 66 | 50-150 | H | 63 | 50-150 |
| 13C2_PFTeDA | N | 21 | 50-150 | N | 27 | 50-150 | HN | 25 | 50-150 |
| 13C3_PFBS | | 72 | 50-150 | | 92 | 50-150 | H | 78 | 50-150 |
| 13C3_PFHxS | | 70 | 50-150 | | 94 | 50-150 | H | 84 | 50-150 |
| 13C4_PFBA | | 70 | 50-150 | | 94 | 50-150 | H | 69 | 50-150 |
| 13C4_PFHpA | | 74 | 50-150 | | 94 | 50-150 | H | 81 | 50-150 |
| 13C5_PFHxA | | 70 | 50-150 | | 99 | 50-150 | H | 93 | 50-150 |
| 13C5_PFPeA | | 71 | 50-150 | | 95 | 50-150 | H | 69 | 50-150 |
| 13C6_PFDA | | 72 | 50-150 | | 91 | 50-150 | H | 75 | 50-150 |
| 13C7_PFUdA | | 72 | 50-150 | | 82 | 50-150 | H | 74 | 50-150 |
| 13C8_PFOA | | 73 | 50-150 | | 91 | 50-150 | H | 77 | 50-150 |
| 13C8_PFOS | | 76 | 50-150 | | 89 | 50-150 | H | 78 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-003
Description: VRTB-D-S2_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1105
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 81 | 50-150 | | 85 | 50-150 | H | 76 | 50-150 |
| 13C9_PFNA | | 78 | 50-150 | | 93 | 50-150 | H | 81 | 50-150 |
| d5-EtFOSAA | | 64 | 50-150 | | 71 | 50-150 | H | 66 | 50-150 |
| d-MeFOSA | N | 42 | 50-150 | N | 48 | 50-150 | H | 53 | 50-150 |
| d3-MeFOSAA | | 78 | 50-150 | | 81 | 50-150 | H | 78 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-003
Description: VRTB-D-S2_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1105 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2016 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 07/29/2022 1157 | LAB | 07/05/2022 0909 | 47070 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/27/2022 2332 | MMM | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.4 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 16 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 5.1 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 31 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 150 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 7.4 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 7.6 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 14 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.9 | HJ | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 16 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UHQ | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 340 | HE | 3.4 | 1.7 | 0.85 | ng/L | 3 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 111 | 50-150 | | 97 | 50-150 | H | 136 | 50-150 |
| 13C2_6:2FTS | | 122 | 50-150 | | 103 | 50-150 | H | 121 | 50-150 |
| 13C2_8:2FTS | | 80 | 50-150 | | 98 | 50-150 | H | 100 | 50-150 |
| 13C2_PFDoA | | 56 | 50-150 | | 66 | 50-150 | H | 63 | 50-150 |
| 13C2_PFTeDA | N | 21 | 50-150 | N | 27 | 50-150 | HN | 25 | 50-150 |
| 13C3_PFBS | | 72 | 50-150 | | 92 | 50-150 | H | 78 | 50-150 |
| 13C3_PFHxS | | 70 | 50-150 | | 94 | 50-150 | H | 84 | 50-150 |
| 13C4_PFBA | | 70 | 50-150 | | 94 | 50-150 | H | 69 | 50-150 |
| 13C4_PFHpA | | 74 | 50-150 | | 94 | 50-150 | H | 81 | 50-150 |
| 13C5_PFHxA | | 70 | 50-150 | | 99 | 50-150 | H | 93 | 50-150 |
| 13C5_PFPeA | | 71 | 50-150 | | 95 | 50-150 | H | 69 | 50-150 |
| 13C6_PFDA | | 72 | 50-150 | | 91 | 50-150 | H | 75 | 50-150 |
| 13C7_PFUdA | | 72 | 50-150 | | 82 | 50-150 | H | 74 | 50-150 |
| 13C8_PFOA | | 73 | 50-150 | | 91 | 50-150 | H | 77 | 50-150 |
| 13C8_PFOS | | 76 | 50-150 | | 89 | 50-150 | H | 78 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-003
Description: VRTB-D-S2_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1105
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 81 | 50-150 | | 85 | 50-150 | H | 76 | 50-150 |
| 13C9_PFNA | | 78 | 50-150 | | 93 | 50-150 | H | 81 | 50-150 |
| d5-EtFOSAA | | 64 | 50-150 | | 71 | 50-150 | H | 66 | 50-150 |
| d-MeFOSA | N | 42 | 50-150 | N | 48 | 50-150 | H | 53 | 50-150 |
| d3-MeFOSAA | | 78 | 50-150 | | 81 | 50-150 | H | 78 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-004
Description: VRTB-D-Y3_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1150 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2048 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/13/2022 1725 | MMM | 07/12/2022 1625 | 47731 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UQ | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 3.4 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.9 | JQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 5.6 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 70 | Q | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 5.1 | B | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 3.2 | J | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 4.4 | | 3.5 | 1.8 | 0.88 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 5.8 | | 3.5 | 1.8 | 0.88 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 3.3 | J | 3.5 | 1.8 | 0.88 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 170 | Q | 3.4 | 1.7 | 0.85 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 60 | 50-150 | | 73 | 50-150 |
| 13C2_6:2FTS | | 59 | 50-150 | | 67 | 50-150 |
| 13C2_8:2FTS | N | 44 | 50-150 | | 52 | 50-150 |
| 13C2_PFDoA | N | 27 | 50-150 | N | 47 | 50-150 |
| 13C2_PFTeDA | N | 12 | 50-150 | N | 27 | 50-150 |
| 13C3_PFBS | | 51 | 50-150 | | 51 | 50-150 |
| 13C3_PFHxS | N | 41 | 50-150 | N | 48 | 50-150 |
| 13C4_PFBA | | 53 | 50-150 | | 70 | 50-150 |
| 13C4_PFHpA | | 53 | 50-150 | | 60 | 50-150 |
| 13C5_PFHxA | N | 44 | 50-150 | | 59 | 50-150 |
| 13C5_PFPeA | N | 48 | 50-150 | | 65 | 50-150 |
| 13C6_PFDA | N | 38 | 50-150 | | 51 | 50-150 |
| 13C7_PFUdA | N | 40 | 50-150 | | 50 | 50-150 |
| 13C8_PFOA | N | 39 | 50-150 | | 54 | 50-150 |
| 13C8_PFOS | N | 37 | 50-150 | N | 42 | 50-150 |
| 13C8_PFOSA | | 75 | 50-150 | | 67 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-004
Description: VRTB-D-Y3_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1150
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | N | 38 | 50-150 | | 55 | 50-150 |
| d5-EtFOSAA | N | 31 | 50-150 | N | 48 | 50-150 |
| d-MeFOSA | N | 39 | 50-150 | N | 45 | 50-150 |
| d3-MeFOSAA | N | 39 | 50-150 | N | 48 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-005
Description: VRTB-D-G4_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1305 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2059 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/27/2022 1625 | MMM | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.6 | U | 7.2 | 3.6 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.6 | U | 7.2 | 3.6 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.6 | U | 7.2 | 3.6 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | U | 7.2 | 3.6 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.6 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | U | 7.2 | 3.6 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.7 | J | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.8 | J | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.2 | J | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.6 | J | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 50 | | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 9.2 | B | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 4.8 | | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 16 | | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 3.8 | | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 28 | B | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UQ | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.90 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 99 | | 3.6 | 1.8 | 0.90 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 113 | 50-150 | H | 123 | 50-150 |
| 13C2_6:2FTS | | 145 | 50-150 | H | 123 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 | H | 109 | 50-150 |
| 13C2_PFDoA | | 75 | 50-150 | H | 90 | 50-150 |
| 13C2_PFTeDA | N | 33 | 50-150 | H | 53 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 | H | 109 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 | H | 112 | 50-150 |
| 13C4_PFBA | | 96 | 50-150 | H | 108 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 | H | 106 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 | H | 108 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 | H | 103 | 50-150 |
| 13C6_PFDA | | 105 | 50-150 | H | 102 | 50-150 |
| 13C7_PFUdA | | 92 | 50-150 | H | 105 | 50-150 |
| 13C8_PFOA | | 100 | 50-150 | H | 106 | 50-150 |
| 13C8_PFOS | | 100 | 50-150 | H | 104 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 | H | 104 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-005
Description: VRTB-D-G4_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1305
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 96 | 50-150 | H | 107 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 | H | 102 | 50-150 |
| d-MeFOSA | | 65 | 50-150 | H | 85 | 50-150 |
| d3-MeFOSAA | | 98 | 50-150 | H | 104 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-005
Description: VRTB-D-G4_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1305 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2059 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/27/2022 1625 | MMM | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.4 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.7 | HJ | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.2 | HJ | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.8 | HJ | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 42 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 7.2 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 4.6 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 17 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 3.5 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 22 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 82 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 113 | 50-150 | H | 123 | 50-150 |
| 13C2_6:2FTS | | 145 | 50-150 | H | 123 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 | H | 109 | 50-150 |
| 13C2_PFDoA | | 75 | 50-150 | H | 90 | 50-150 |
| 13C2_PFTeDA | N | 33 | 50-150 | H | 53 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 | H | 109 | 50-150 |
| 13C3_PFHxS | | 95 | 50-150 | H | 112 | 50-150 |
| 13C4_PFBA | | 96 | 50-150 | H | 108 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 | H | 106 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 | H | 108 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 | H | 103 | 50-150 |
| 13C6_PFDA | | 105 | 50-150 | H | 102 | 50-150 |
| 13C7_PFUdA | | 92 | 50-150 | H | 105 | 50-150 |
| 13C8_PFOA | | 100 | 50-150 | H | 106 | 50-150 |
| 13C8_PFOS | | 100 | 50-150 | H | 104 | 50-150 |
| 13C8_PFOSA | | 103 | 50-150 | H | 104 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-005
Description: VRTB-D-G4_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1305
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 96 | 50-150 | H | 107 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 | H | 102 | 50-150 |
| d-MeFOSA | | 65 | 50-150 | H | 85 | 50-150 |
| d3-MeFOSAA | | 98 | 50-150 | H | 104 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-006
Description: MW-VRTB-1D_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1350 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2109 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/25/2022 2200 | LAB | 07/05/2022 0909 | 47070 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.5 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 6.5 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 12 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 190 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 13 | B | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 12 | | 3.4 | 1.7 | 0.86 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 22 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.89 | J | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 17 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 20 | B | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 180 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 90 | 50-150 | | 113 | 50-150 |
| 13C2_6:2FTS | | 117 | 50-150 | N | 160 | 50-150 |
| 13C2_8:2FTS | | 83 | 50-150 | | 92 | 50-150 |
| 13C2_PFDoA | | 66 | 50-150 | | 105 | 50-150 |
| 13C2_PFTeDA | | 58 | 50-150 | | 109 | 50-150 |
| 13C3_PFBS | | 74 | 50-150 | | 112 | 50-150 |
| 13C3_PFHxS | | 74 | 50-150 | | 91 | 50-150 |
| 13C4_PFBA | | 84 | 50-150 | | 104 | 50-150 |
| 13C4_PFHpA | | 81 | 50-150 | | 108 | 50-150 |
| 13C5_PFHxA | | 75 | 50-150 | | 110 | 50-150 |
| 13C5_PFPeA | | 75 | 50-150 | | 100 | 50-150 |
| 13C6_PFDA | | 79 | 50-150 | | 127 | 50-150 |
| 13C7_PFUdA | | 75 | 50-150 | | 101 | 50-150 |
| 13C8_PFOA | | 80 | 50-150 | | 110 | 50-150 |
| 13C8_PFOS | | 79 | 50-150 | | 110 | 50-150 |
| 13C8_PFOSA | | 99 | 50-150 | | 113 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-006
Description: MW-VRTB-1D_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1350
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 83 | 50-150 | | 106 | 50-150 |
| d5-EtFOSAA | | 70 | 50-150 | | 106 | 50-150 |
| d-MeFOSA | | 65 | 50-150 | | 91 | 50-150 |
| d3-MeFOSAA | | 77 | 50-150 | | 116 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-007
Description: MW-VRTB-1S_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1425 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2120 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 07/28/2022 1537 | MMM | 07/12/2022 1625 | 47731 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/13/2022 1736 | MMM | 07/12/2022 1625 | 47731 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 52 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 150 | | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 19 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 120 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 43 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 2000 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 76 | B | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 160 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 250 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 72 | Q | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 300 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 190 | B | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 14000 | EQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 | H | 101 | 50-150 | | 120 | 50-150 |
| 13C2_6:2FTS | | 104 | 50-150 | H | 106 | 50-150 | | 103 | 50-150 |
| 13C2_8:2FTS | | 71 | 50-150 | H | 107 | 50-150 | | 92 | 50-150 |
| 13C2_PFDoA | | 54 | 50-150 | H | 114 | 50-150 | | 94 | 50-150 |
| 13C2_PFTeDA | N | 41 | 50-150 | H | 108 | 50-150 | | 87 | 50-150 |
| 13C3_PFBS | | 77 | 50-150 | H | 105 | 50-150 | | 98 | 50-150 |
| 13C3_PFHxS | | 63 | 50-150 | H | 105 | 50-150 | | 76 | 50-150 |
| 13C4_PFBA | | 77 | 50-150 | H | 110 | 50-150 | | 89 | 50-150 |
| 13C4_PFHpA | | 73 | 50-150 | H | 111 | 50-150 | | 87 | 50-150 |
| 13C5_PFHxA | | 70 | 50-150 | H | 113 | 50-150 | | 95 | 50-150 |
| 13C5_PFPeA | | 75 | 50-150 | H | 106 | 50-150 | | 92 | 50-150 |
| 13C6_PFDA | | 75 | 50-150 | H | 110 | 50-150 | | 94 | 50-150 |
| 13C7_PFUdA | | 70 | 50-150 | H | 112 | 50-150 | | 97 | 50-150 |
| 13C8_PFOA | | 78 | 50-150 | H | 105 | 50-150 | | 96 | 50-150 |
| 13C8_PFOS | N | 36 | 50-150 | H | 109 | 50-150 | N | 45 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-007
Description: MW-VRTB-1S_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1425
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | N | 151 | 50-150 | H | 108 | 50-150 | | 103 | 50-150 |
| 13C9_PFNA | N | 40 | 50-150 | H | 109 | 50-150 | N | 48 | 50-150 |
| d5-EtFOSAA | | 63 | 50-150 | H | 101 | 50-150 | | 97 | 50-150 |
| d-MeFOSA | | 50 | 50-150 | H | 114 | 50-150 | | 80 | 50-150 |
| d3-MeFOSAA | | 75 | 50-150 | H | 101 | 50-150 | | 96 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-007
Description: MW-VRTB-1S_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1425 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2120 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 07/28/2022 1537 | MMM | 07/12/2022 1625 | 47731 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/13/2022 1736 | MMM | 07/12/2022 1625 | 47731 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 350 | UH | 690 | 350 | 170 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 180 | HJ | 690 | 350 | 170 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 350 | UH | 690 | 350 | 170 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 350 | UH | 690 | 350 | 170 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 700 | UH | 1400 | 700 | 350 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 350 | UH | 690 | 350 | 170 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 87 | HJ | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1900 | H | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 180 | HJ | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 240 | HJ | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 340 | HJ | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 190 | HJ | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 180 | UH | 350 | 180 | 87 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 13000 | H | 350 | 180 | 87 | ng/L | 2 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 | H | 101 | 50-150 | | 120 | 50-150 |
| 13C2_6:2FTS | | 104 | 50-150 | H | 106 | 50-150 | | 103 | 50-150 |
| 13C2_8:2FTS | | 71 | 50-150 | H | 107 | 50-150 | | 92 | 50-150 |
| 13C2_PFDoA | | 54 | 50-150 | H | 114 | 50-150 | | 94 | 50-150 |
| 13C2_PFTeDA | N | 41 | 50-150 | H | 108 | 50-150 | | 87 | 50-150 |
| 13C3_PFBS | | 77 | 50-150 | H | 105 | 50-150 | | 98 | 50-150 |
| 13C3_PFHxS | | 63 | 50-150 | H | 105 | 50-150 | | 76 | 50-150 |
| 13C4_PFBA | | 77 | 50-150 | H | 110 | 50-150 | | 89 | 50-150 |
| 13C4_PFHpA | | 73 | 50-150 | H | 111 | 50-150 | | 87 | 50-150 |
| 13C5_PFHxA | | 70 | 50-150 | H | 113 | 50-150 | | 95 | 50-150 |
| 13C5_PFPeA | | 75 | 50-150 | H | 106 | 50-150 | | 92 | 50-150 |
| 13C6_PFDA | | 75 | 50-150 | H | 110 | 50-150 | | 94 | 50-150 |
| 13C7_PFUdA | | 70 | 50-150 | H | 112 | 50-150 | | 97 | 50-150 |
| 13C8_PFOA | | 78 | 50-150 | H | 105 | 50-150 | | 96 | 50-150 |
| 13C8_PFOS | N | 36 | 50-150 | H | 109 | 50-150 | N | 45 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-007
Description: MW-VRTB-1S_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1425
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | N | 151 | 50-150 | H | 108 | 50-150 | | 103 | 50-150 |
| 13C9_PFNA | N | 40 | 50-150 | H | 109 | 50-150 | N | 48 | 50-150 |
| d5-EtFOSAA | | 63 | 50-150 | H | 101 | 50-150 | | 97 | 50-150 |
| d-MeFOSA | | 50 | 50-150 | H | 114 | 50-150 | | 80 | 50-150 |
| d3-MeFOSAA | | 75 | 50-150 | H | 101 | 50-150 | | 96 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-007
Description: MW-VRTB-1S_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1425 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2120 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 07/28/2022 1537 | MMM | 07/12/2022 1625 | 47731 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/13/2022 1736 | MMM | 07/12/2022 1625 | 47731 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 54 | | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 140 | | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 18 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 100 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 40 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1800 | E | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 69 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 150 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 200 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 67 | Q | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 280 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 170 | | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 14000 | EQ | 3.5 | 1.8 | 0.87 | ng/L | 3 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits | Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 | H | 101 | 50-150 | | 120 | 50-150 |
| 13C2_6:2FTS | | 104 | 50-150 | H | 106 | 50-150 | | 103 | 50-150 |
| 13C2_8:2FTS | | 71 | 50-150 | H | 107 | 50-150 | | 92 | 50-150 |
| 13C2_PFDoA | | 54 | 50-150 | H | 114 | 50-150 | | 94 | 50-150 |
| 13C2_PFTeDA | N | 41 | 50-150 | H | 108 | 50-150 | | 87 | 50-150 |
| 13C3_PFBS | | 77 | 50-150 | H | 105 | 50-150 | | 98 | 50-150 |
| 13C3_PFHxS | | 63 | 50-150 | H | 105 | 50-150 | | 76 | 50-150 |
| 13C4_PFBA | | 77 | 50-150 | H | 110 | 50-150 | | 89 | 50-150 |
| 13C4_PFHpA | | 73 | 50-150 | H | 111 | 50-150 | | 87 | 50-150 |
| 13C5_PFHxA | | 70 | 50-150 | H | 113 | 50-150 | | 95 | 50-150 |
| 13C5_PFPeA | | 75 | 50-150 | H | 106 | 50-150 | | 92 | 50-150 |
| 13C6_PFDA | | 75 | 50-150 | H | 110 | 50-150 | | 94 | 50-150 |
| 13C7_PFUdA | | 70 | 50-150 | H | 112 | 50-150 | | 97 | 50-150 |
| 13C8_PFOA | | 78 | 50-150 | H | 105 | 50-150 | | 96 | 50-150 |
| 13C8_PFOS | N | 36 | 50-150 | H | 109 | 50-150 | N | 45 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-007
Description: MW-VRTB-1S_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1425
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | N | 151 | 50-150 | H | 108 | 50-150 | | 103 | 50-150 |
| 13C9_PFNA | N | 40 | 50-150 | H | 109 | 50-150 | N | 48 | 50-150 |
| d5-EtFOSAA | | 63 | 50-150 | H | 101 | 50-150 | | 97 | 50-150 |
| d-MeFOSA | | 50 | 50-150 | H | 114 | 50-150 | | 80 | 50-150 |
| d3-MeFOSAA | | 75 | 50-150 | H | 101 | 50-150 | | 96 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-009
Description: CMT-VRTB-01_2_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1610 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2130 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 07/28/2022 1515 | MMM | 07/20/2022 1618 | 48567 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 200 | 07/28/2022 1504 | MMM | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 54 | | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 100 | | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 50 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 230 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.88 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 120 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 3200 | E | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 48 | B | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 130 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 330 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 91 | Q | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 240 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 130 | B | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 26000 | EQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 | H | 113 | 50-150 | | 106 | 50-150 |
| 13C2_6:2FTS | | 130 | 50-150 | H | 123 | 50-150 | | 105 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 | H | 111 | 50-150 | | 105 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 | H | 106 | 50-150 | | 109 | 50-150 |
| 13C2_PFTeDA | | 63 | 50-150 | H | 101 | 50-150 | | 105 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 | H | 114 | 50-150 | | 102 | 50-150 |
| 13C3_PFHxS | | 64 | 50-150 | H | 112 | 50-150 | H | 104 | 50-150 |
| 13C4_PFBA | | 81 | 50-150 | H | 114 | 50-150 | | 107 | 50-150 |
| 13C4_PFHpA | | 81 | 50-150 | H | 117 | 50-150 | | 108 | 50-150 |
| 13C5_PFHxA | | 87 | 50-150 | H | 115 | 50-150 | | 109 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | H | 113 | 50-150 | | 100 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 | H | 114 | 50-150 | | 109 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 | H | 108 | 50-150 | | 106 | 50-150 |
| 13C8_PFOA | | 94 | 50-150 | H | 109 | 50-150 | | 101 | 50-150 |
| 13C8_PFOS | N | 33 | 50-150 | H | 108 | 50-150 | H | 105 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-009
Description: CMT-VRTB-01_2_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1610
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 111 | 50-150 | H | 114 | 50-150 | | 107 | 50-150 |
| 13C9_PFNA | N | 30 | 50-150 | H | 104 | 50-150 | | 107 | 50-150 |
| d5-EtFOSAA | | 80 | 50-150 | H | 98 | 50-150 | | 102 | 50-150 |
| d-MeFOSA | | 69 | 50-150 | H | 118 | 50-150 | | 113 | 50-150 |
| d3-MeFOSAA | | 110 | 50-150 | H | 111 | 50-150 | | 104 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-009
Description: CMT-VRTB-01_2_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1610 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2130 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 07/28/2022 1515 | MMM | 07/20/2022 1618 | 48567 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 200 | 07/28/2022 1504 | MMM | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 51 | HJ | 140 | 70 | 34 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 110 | HJ | 140 | 70 | 34 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 70 | UH | 140 | 70 | 34 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 70 | UH | 140 | 70 | 34 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 140 | UH | 270 | 140 | 68 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 70 | UH | 140 | 70 | 34 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 45 | HJ | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 34 | UH | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 150 | H | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 34 | UH | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 34 | UH | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 120 | H | 68 | 34 | 17 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 3100 | H | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 46 | HJ | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 34 | UH | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 34 | UH | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 130 | H | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 320 | H | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 77 | H | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 250 | H | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 120 | H | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 34 | UH | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 34 | UH | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 34 | UH | 68 | 34 | 17 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 27000 | HE | 68 | 34 | 17 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 | H | 113 | 50-150 | | 106 | 50-150 |
| 13C2_6:2FTS | | 130 | 50-150 | H | 123 | 50-150 | | 105 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 | H | 111 | 50-150 | | 105 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 | H | 106 | 50-150 | | 109 | 50-150 |
| 13C2_PFTeDA | | 63 | 50-150 | H | 101 | 50-150 | | 105 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 | H | 114 | 50-150 | | 102 | 50-150 |
| 13C3_PFHxS | | 64 | 50-150 | H | 112 | 50-150 | H | 104 | 50-150 |
| 13C4_PFBA | | 81 | 50-150 | H | 114 | 50-150 | | 107 | 50-150 |
| 13C4_PFHpA | | 81 | 50-150 | H | 117 | 50-150 | | 108 | 50-150 |
| 13C5_PFHxA | | 87 | 50-150 | H | 115 | 50-150 | | 109 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | H | 113 | 50-150 | | 100 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 | H | 114 | 50-150 | | 109 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 | H | 108 | 50-150 | | 106 | 50-150 |
| 13C8_PFOA | | 94 | 50-150 | H | 109 | 50-150 | | 101 | 50-150 |
| 13C8_PFOS | N | 33 | 50-150 | H | 108 | 50-150 | H | 105 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-009
Description: CMT-VRTB-01_2_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1610
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 111 | 50-150 | H | 114 | 50-150 | | 107 | 50-150 |
| 13C9_PFNA | N | 30 | 50-150 | H | 104 | 50-150 | | 107 | 50-150 |
| d5-EtFOSAA | | 80 | 50-150 | H | 98 | 50-150 | | 102 | 50-150 |
| d-MeFOSA | | 69 | 50-150 | H | 118 | 50-150 | | 113 | 50-150 |
| d3-MeFOSAA | | 110 | 50-150 | H | 111 | 50-150 | | 104 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-009
Description: CMT-VRTB-01_2_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1610 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2130 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 07/28/2022 1515 | MMM | 07/20/2022 1618 | 48567 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 200 | 07/28/2022 1504 | MMM | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 700 | U | 1400 | 700 | 340 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 700 | U | 1400 | 700 | 340 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 700 | U | 1400 | 700 | 340 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 700 | U | 1400 | 700 | 340 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1400 | U | 2700 | 1400 | 680 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 700 | U | 1400 | 700 | 340 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 340 | UH | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 340 | UH | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 3500 | H | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 350 | J | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 380 | J | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 33000 | H | 680 | 340 | 170 | ng/L | 3 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 | H | 113 | 50-150 | | 106 | 50-150 |
| 13C2_6:2FTS | | 130 | 50-150 | H | 123 | 50-150 | | 105 | 50-150 |
| 13C2_8:2FTS | | 105 | 50-150 | H | 111 | 50-150 | | 105 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 | H | 106 | 50-150 | | 109 | 50-150 |
| 13C2_PFTeDA | | 63 | 50-150 | H | 101 | 50-150 | | 105 | 50-150 |
| 13C3_PFBS | | 85 | 50-150 | H | 114 | 50-150 | | 102 | 50-150 |
| 13C3_PFHxS | | 64 | 50-150 | H | 112 | 50-150 | H | 104 | 50-150 |
| 13C4_PFBA | | 81 | 50-150 | H | 114 | 50-150 | | 107 | 50-150 |
| 13C4_PFHpA | | 81 | 50-150 | H | 117 | 50-150 | | 108 | 50-150 |
| 13C5_PFHxA | | 87 | 50-150 | H | 115 | 50-150 | | 109 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 | H | 113 | 50-150 | | 100 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 | H | 114 | 50-150 | | 109 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 | H | 108 | 50-150 | | 106 | 50-150 |
| 13C8_PFOA | | 94 | 50-150 | H | 109 | 50-150 | | 101 | 50-150 |
| 13C8_PFOS | N | 33 | 50-150 | H | 108 | 50-150 | H | 105 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-009
Description: CMT-VRTB-01_2_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1610
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 111 | 50-150 | H | 114 | 50-150 | | 107 | 50-150 |
| 13C9_PFNA | N | 30 | 50-150 | H | 104 | 50-150 | | 107 | 50-150 |
| d5-EtFOSAA | | 80 | 50-150 | H | 98 | 50-150 | | 102 | 50-150 |
| d-MeFOSA | | 69 | 50-150 | H | 118 | 50-150 | | 113 | 50-150 |
| d3-MeFOSAA | | 110 | 50-150 | H | 111 | 50-150 | | 104 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-010
Description: CMT-VRTB-01_3_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1650 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2141 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 08/04/2022 1451 | MMM | 07/05/2022 0909 | 47070 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/13/2022 1747 | MMM | 07/12/2022 1625 | 47731 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 11 | Q | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 17 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 18 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 30 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 680 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 43 | B | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 72 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 160 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 16 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 58 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 98 | B | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2500 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits | Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 108 | 50-150 | H | 141 | 50-150 | | 105 | 50-150 |
| 13C2_6:2FTS | N | 186 | 50-150 | H | 112 | 50-150 | | 119 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 | H | 109 | 50-150 | | 95 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 | H | 92 | 50-150 | | 96 | 50-150 |
| 13C2_PFTeDA | | 80 | 50-150 | H | 87 | 50-150 | | 86 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 | H | 106 | 50-150 | | 99 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 | H | 102 | 50-150 | | 85 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 | H | 117 | 50-150 | | 88 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 | H | 114 | 50-150 | | 91 | 50-150 |
| 13C5_PFHxA | | 90 | 50-150 | H | 117 | 50-150 | | 96 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 | H | 113 | 50-150 | | 94 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 | H | 106 | 50-150 | | 95 | 50-150 |
| 13C7_PFUdA | | 105 | 50-150 | H | 101 | 50-150 | | 93 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 | H | 114 | 50-150 | | 102 | 50-150 |
| 13C8_PFOS | | 81 | 50-150 | H | 113 | 50-150 | | 77 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-010
Description: CMT-VRTB-01_3_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1650
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 116 | 50-150 | H | 114 | 50-150 | | 106 | 50-150 |
| 13C9_PFNA | | 83 | 50-150 | H | 105 | 50-150 | | 77 | 50-150 |
| d5-EtFOSAA | | 90 | 50-150 | H | 92 | 50-150 | | 98 | 50-150 |
| d-MeFOSA | | 68 | 50-150 | H | 78 | 50-150 | | 78 | 50-150 |
| d3-MeFOSAA | | 100 | 50-150 | H | 106 | 50-150 | | 96 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-010
Description: CMT-VRTB-01_3_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1650 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2141 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 08/04/2022 1451 | MMM | 07/05/2022 0909 | 47070 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/13/2022 1747 | MMM | 07/12/2022 1625 | 47731 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 70 | UH | 140 | 70 | 34 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 70 | UH | 140 | 70 | 34 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 70 | UH | 140 | 70 | 34 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 70 | UH | 140 | 70 | 34 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 140 | UH | 270 | 140 | 69 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 70 | UH | 140 | 70 | 34 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 20 | HJ | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 35 | UH | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 20 | HJ | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 35 | UH | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 35 | UH | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 40 | HJ | 69 | 35 | 17 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 730 | H | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 46 | BHJ | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 35 | UH | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 35 | UH | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 92 | H | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 150 | H | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 17 | HJ | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 65 | HJ | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 100 | BH | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 35 | UH | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 35 | UH | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 35 | UH | 69 | 35 | 17 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2300 | H | 69 | 35 | 17 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 108 | 50-150 | H | 141 | 50-150 | | 105 | 50-150 |
| 13C2_6:2FTS | N | 186 | 50-150 | H | 112 | 50-150 | | 119 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 | H | 109 | 50-150 | | 95 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 | H | 92 | 50-150 | | 96 | 50-150 |
| 13C2_PFTeDA | | 80 | 50-150 | H | 87 | 50-150 | | 86 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 | H | 106 | 50-150 | | 99 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 | H | 102 | 50-150 | | 85 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 | H | 117 | 50-150 | | 88 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 | H | 114 | 50-150 | | 91 | 50-150 |
| 13C5_PFHxA | | 90 | 50-150 | H | 117 | 50-150 | | 96 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 | H | 113 | 50-150 | | 94 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 | H | 106 | 50-150 | | 95 | 50-150 |
| 13C7_PFUdA | | 105 | 50-150 | H | 101 | 50-150 | | 93 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 | H | 114 | 50-150 | | 102 | 50-150 |
| 13C8_PFOS | | 81 | 50-150 | H | 113 | 50-150 | | 77 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-010
Description: CMT-VRTB-01_3_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1650
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 116 | 50-150 | H | 114 | 50-150 | | 106 | 50-150 |
| 13C9_PFNA | | 83 | 50-150 | H | 105 | 50-150 | | 77 | 50-150 |
| d5-EtFOSAA | | 90 | 50-150 | H | 92 | 50-150 | | 98 | 50-150 |
| d-MeFOSA | | 68 | 50-150 | H | 78 | 50-150 | | 78 | 50-150 |
| d3-MeFOSAA | | 100 | 50-150 | H | 106 | 50-150 | | 96 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-010
Description: CMT-VRTB-01_3_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1650 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2141 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 08/04/2022 1451 | MMM | 07/05/2022 0909 | 47070 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/13/2022 1747 | MMM | 07/12/2022 1625 | 47731 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 5.8 | J | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 17 | | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 18 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 18 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 35 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 730 | E | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 42 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 85 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 150 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 16 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 58 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 99 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2600 | E | 3.4 | 1.7 | 0.85 | ng/L | 3 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 108 | 50-150 | H | 141 | 50-150 | | 105 | 50-150 |
| 13C2_6:2FTS | N | 186 | 50-150 | H | 112 | 50-150 | | 119 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 | H | 109 | 50-150 | | 95 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 | H | 92 | 50-150 | | 96 | 50-150 |
| 13C2_PFTeDA | | 80 | 50-150 | H | 87 | 50-150 | | 86 | 50-150 |
| 13C3_PFBS | | 94 | 50-150 | H | 106 | 50-150 | | 99 | 50-150 |
| 13C3_PFHxS | | 91 | 50-150 | H | 102 | 50-150 | | 85 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 | H | 117 | 50-150 | | 88 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 | H | 114 | 50-150 | | 91 | 50-150 |
| 13C5_PFHxA | | 90 | 50-150 | H | 117 | 50-150 | | 96 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 | H | 113 | 50-150 | | 94 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 | H | 106 | 50-150 | | 95 | 50-150 |
| 13C7_PFUdA | | 105 | 50-150 | H | 101 | 50-150 | | 93 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 | H | 114 | 50-150 | | 102 | 50-150 |
| 13C8_PFOS | | 81 | 50-150 | H | 113 | 50-150 | | 77 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-010
Description: CMT-VRTB-01_3_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1650
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 116 | 50-150 | H | 114 | 50-150 | | 106 | 50-150 |
| 13C9_PFNA | | 83 | 50-150 | H | 105 | 50-150 | | 77 | 50-150 |
| d5-EtFOSAA | | 90 | 50-150 | H | 92 | 50-150 | | 98 | 50-150 |
| d-MeFOSA | | 68 | 50-150 | H | 78 | 50-150 | | 78 | 50-150 |
| d3-MeFOSAA | | 100 | 50-150 | H | 106 | 50-150 | | 96 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-011
Description: CMT-VRTB-01_4_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1725 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/07/2022 2152 | LAB | 07/05/2022 0909 | 47070 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 07/10/2022 2234 | LAB | 07/05/2022 0909 | 47070 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/13/2022 1758 | MMM | 07/12/2022 1625 | 47731 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1.7 | J | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 6.5 | U | 13 | 6.5 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.7 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 11 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 9.3 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 0.92 | J | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 15 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 280 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 15 | B | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 15 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 30 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 4.9 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 29 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 21 | | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 730 | Q | 67 | 34 | 17 | ng/L | 2 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 85 | 50-150 | HN | 187 | 50-150 | | 114 | 50-150 |
| 13C2_6:2FTS | | 125 | 50-150 | HN | 212 | 50-150 | | 123 | 50-150 |
| 13C2_8:2FTS | | 72 | 50-150 | HN | 198 | 50-150 | | 95 | 50-150 |
| 13C2_PFDoA | | 56 | 50-150 | HN | 151 | 50-150 | | 96 | 50-150 |
| 13C2_PFTeDA | N | 47 | 50-150 | H | 142 | 50-150 | | 89 | 50-150 |
| 13C3_PFBS | | 72 | 50-150 | HN | 182 | 50-150 | | 99 | 50-150 |
| 13C3_PFHxS | | 66 | 50-150 | HN | 177 | 50-150 | | 93 | 50-150 |
| 13C4_PFBA | | 79 | 50-150 | HN | 169 | 50-150 | | 96 | 50-150 |
| 13C4_PFHpA | | 76 | 50-150 | HN | 182 | 50-150 | | 93 | 50-150 |
| 13C5_PFHxA | | 70 | 50-150 | HN | 177 | 50-150 | | 99 | 50-150 |
| 13C5_PFPeA | | 73 | 50-150 | HN | 174 | 50-150 | | 96 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 | HN | 173 | 50-150 | | 96 | 50-150 |
| 13C7_PFUdA | | 63 | 50-150 | HN | 174 | 50-150 | | 95 | 50-150 |
| 13C8_PFOA | | 71 | 50-150 | HN | 196 | 50-150 | | 106 | 50-150 |
| 13C8_PFOS | | 69 | 50-150 | N | 155 | 50-150 | | 90 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-011
Description: CMT-VRTB-01_4_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1725
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 96 | 50-150 | HN | 179 | 50-150 | | 109 | 50-150 |
| 13C9_PFNA | | 71 | 50-150 | HN | 168 | 50-150 | | 93 | 50-150 |
| d5-EtFOSAA | | 61 | 50-150 | HN | 167 | 50-150 | | 100 | 50-150 |
| d-MeFOSA | | 59 | 50-150 | HN | 164 | 50-150 | | 82 | 50-150 |
| d3-MeFOSAA | | 71 | 50-150 | HN | 191 | 50-150 | | 99 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-012
Description: CMT-VRTB-01_5_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1810 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/10/2022 2306 | LAB | 07/07/2022 1706 | 47309 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/25/2022 2222 | LAB | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 11 | Q | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UQ | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 1.1 | JQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 0.97 | JQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 3.6 | Q | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 20 | 50-150 | H | 137 | 50-150 |
| 13C2_6:2FTS | N | 23 | 50-150 | HN | 218 | 50-150 |
| 13C2_8:2FTS | N | 23 | 50-150 | H | 99 | 50-150 |
| 13C2_PFDoA | N | 20 | 50-150 | H | 102 | 50-150 |
| 13C2_PFTeDA | N | 14 | 50-150 | H | 107 | 50-150 |
| 13C3_PFBS | N | 22 | 50-150 | H | 113 | 50-150 |
| 13C3_PFHxS | N | 20 | 50-150 | H | 102 | 50-150 |
| 13C4_PFBA | N | 19 | 50-150 | H | 110 | 50-150 |
| 13C4_PFHpA | N | 20 | 50-150 | H | 113 | 50-150 |
| 13C5_PFHxA | N | 22 | 50-150 | H | 116 | 50-150 |
| 13C5_PFPeA | N | 19 | 50-150 | H | 108 | 50-150 |
| 13C6_PFDA | N | 20 | 50-150 | H | 119 | 50-150 |
| 13C7_PFUdA | N | 22 | 50-150 | H | 107 | 50-150 |
| 13C8_PFOA | N | 21 | 50-150 | H | 121 | 50-150 |
| 13C8_PFOS | N | 20 | 50-150 | H | 112 | 50-150 |
| 13C8_PFOSA | N | 20 | 50-150 | H | 114 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-012
Description: CMT-VRTB-01_5_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1810
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | N | 20 | 50-150 | H | 112 | 50-150 |
| d5-EtFOSAA | N | 21 | 50-150 | H | 103 | 50-150 |
| d-MeFOSA | N | 13 | 50-150 | H | 97 | 50-150 |
| d3-MeFOSAA | N | 28 | 50-150 | H | 123 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-012
Description: CMT-VRTB-01_5_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1810 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/10/2022 2306 | LAB | 07/07/2022 1706 | 47309 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/25/2022 2222 | LAB | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UHQ | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 6.5 | UH | 13 | 6.5 | 3.4 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | UH | 6.7 | 3.4 | 1.7 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.3 | H | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 4.7 | H | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 12 | H | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 190 | H | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 10 | H | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 12 | H | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 21 | H | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.2 | HJ | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 21 | H | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 16 | H | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 99 | H | 3.4 | 1.7 | 0.84 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 20 | 50-150 | H | 137 | 50-150 |
| 13C2_6:2FTS | N | 23 | 50-150 | HN | 218 | 50-150 |
| 13C2_8:2FTS | N | 23 | 50-150 | H | 99 | 50-150 |
| 13C2_PFDoA | N | 20 | 50-150 | H | 102 | 50-150 |
| 13C2_PFTeDA | N | 14 | 50-150 | H | 107 | 50-150 |
| 13C3_PFBS | N | 22 | 50-150 | H | 113 | 50-150 |
| 13C3_PFHxS | N | 20 | 50-150 | H | 102 | 50-150 |
| 13C4_PFBA | N | 19 | 50-150 | H | 110 | 50-150 |
| 13C4_PFHpA | N | 20 | 50-150 | H | 113 | 50-150 |
| 13C5_PFHxA | N | 22 | 50-150 | H | 116 | 50-150 |
| 13C5_PFPeA | N | 19 | 50-150 | H | 108 | 50-150 |
| 13C6_PFDA | N | 20 | 50-150 | H | 119 | 50-150 |
| 13C7_PFUdA | N | 22 | 50-150 | H | 107 | 50-150 |
| 13C8_PFOA | N | 21 | 50-150 | H | 121 | 50-150 |
| 13C8_PFOS | N | 20 | 50-150 | H | 112 | 50-150 |
| 13C8_PFOSA | N | 20 | 50-150 | H | 114 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-012
Description: CMT-VRTB-01_5_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1810
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | N | 20 | 50-150 | H | 112 | 50-150 |
| d5-EtFOSAA | N | 21 | 50-150 | H | 103 | 50-150 |
| d-MeFOSA | N | 13 | 50-150 | H | 97 | 50-150 |
| d3-MeFOSAA | N | 28 | 50-150 | H | 123 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-013
Description: CMT-VRTB-01_6_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1845 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/08/2022 2041 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/25/2022 2232 | LAB | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 10 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.2 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.5 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 17 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 220 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 16 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 12 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 28 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 22 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 27 | B | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 120 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 153 | 50-150 | H | 115 | 50-150 |
| 13C2_6:2FTS | N | 242 | 50-150 | HN | 151 | 50-150 |
| 13C2_8:2FTS | | 140 | 50-150 | H | 86 | 50-150 |
| 13C2_PFDoA | | 118 | 50-150 | H | 113 | 50-150 |
| 13C2_PFTeDA | | 100 | 50-150 | H | 105 | 50-150 |
| 13C3_PFBS | | 135 | 50-150 | H | 111 | 50-150 |
| 13C3_PFHxS | | 134 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | | 121 | 50-150 | H | 110 | 50-150 |
| 13C4_PFHpA | | 130 | 50-150 | H | 112 | 50-150 |
| 13C5_PFHxA | | 136 | 50-150 | H | 112 | 50-150 |
| 13C5_PFPeA | | 126 | 50-150 | H | 107 | 50-150 |
| 13C6_PFDA | | 130 | 50-150 | H | 110 | 50-150 |
| 13C7_PFUdA | | 124 | 50-150 | H | 107 | 50-150 |
| 13C8_PFOA | | 145 | 50-150 | H | 110 | 50-150 |
| 13C8_PFOS | | 134 | 50-150 | H | 104 | 50-150 |
| 13C8_PFOSA | | 150 | 50-150 | H | 111 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-013
Description: CMT-VRTB-01_6_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1845
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 132 | 50-150 | H | 106 | 50-150 |
| d5-EtFOSAA | | 116 | 50-150 | H | 98 | 50-150 |
| d-MeFOSA | | 96 | 50-150 | H | 107 | 50-150 |
| d3-MeFOSAA | | 136 | 50-150 | H | 115 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-013
Description: CMT-VRTB-01_6_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1845 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/08/2022 2041 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/25/2022 2232 | LAB | 07/20/2022 1618 | 48567 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UHQ | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.4 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.0 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 5.8 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 14 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 180 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 12 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 10 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 25 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 20 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 100 | H | 3.4 | 1.7 | 0.85 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 153 | 50-150 | H | 115 | 50-150 |
| 13C2_6:2FTS | N | 242 | 50-150 | HN | 151 | 50-150 |
| 13C2_8:2FTS | | 140 | 50-150 | H | 86 | 50-150 |
| 13C2_PFDoA | | 118 | 50-150 | H | 113 | 50-150 |
| 13C2_PFTeDA | | 100 | 50-150 | H | 105 | 50-150 |
| 13C3_PFBS | | 135 | 50-150 | H | 111 | 50-150 |
| 13C3_PFHxS | | 134 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | | 121 | 50-150 | H | 110 | 50-150 |
| 13C4_PFHpA | | 130 | 50-150 | H | 112 | 50-150 |
| 13C5_PFHxA | | 136 | 50-150 | H | 112 | 50-150 |
| 13C5_PFPeA | | 126 | 50-150 | H | 107 | 50-150 |
| 13C6_PFDA | | 130 | 50-150 | H | 110 | 50-150 |
| 13C7_PFUdA | | 124 | 50-150 | H | 107 | 50-150 |
| 13C8_PFOA | | 145 | 50-150 | H | 110 | 50-150 |
| 13C8_PFOS | | 134 | 50-150 | H | 104 | 50-150 |
| 13C8_PFOSA | | 150 | 50-150 | H | 111 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-013
Description: CMT-VRTB-01_6_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1845
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 132 | 50-150 | H | 106 | 50-150 |
| d5-EtFOSAA | | 116 | 50-150 | H | 98 | 50-150 |
| d-MeFOSA | | 96 | 50-150 | H | 107 | 50-150 |
| d3-MeFOSAA | | 136 | 50-150 | H | 115 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-014
Description: CMT-VRTB-01_7_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1910 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/08/2022 2052 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 07/11/2022 1351 | MMM | 07/05/2022 0855 | 47073 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/15/2022 1344 | MMM | 07/13/2022 1216 | 47821 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 6.1 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 8.0 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 5.4 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 160 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 8.6 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 8.3 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 13 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.5 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 17 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 10 | B | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 650 | E | 3.4 | 1.7 | 0.85 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 150 | 50-150 | | 138 | 50-150 | H | 115 | 50-150 |
| 13C2_6:2FTS | N | 161 | 50-150 | | 144 | 50-150 | HN | 159 | 50-150 |
| 13C2_8:2FTS | | 122 | 50-150 | | 136 | 50-150 | H | 94 | 50-150 |
| 13C2_PFDoA | | 98 | 50-150 | | 104 | 50-150 | H | 95 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 | | 84 | 50-150 | H | 95 | 50-150 |
| 13C3_PFBS | | 116 | 50-150 | | 124 | 50-150 | H | 107 | 50-150 |
| 13C3_PFHxS | | 114 | 50-150 | | 119 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 | | 119 | 50-150 | H | 96 | 50-150 |
| 13C4_PFHpA | | 113 | 50-150 | | 114 | 50-150 | H | 100 | 50-150 |
| 13C5_PFHxA | | 120 | 50-150 | | 119 | 50-150 | H | 106 | 50-150 |
| 13C5_PFPeA | | 112 | 50-150 | | 118 | 50-150 | H | 107 | 50-150 |
| 13C6_PFDA | | 108 | 50-150 | | 110 | 50-150 | H | 99 | 50-150 |
| 13C7_PFUdA | | 108 | 50-150 | | 107 | 50-150 | H | 102 | 50-150 |
| 13C8_PFOA | | 116 | 50-150 | | 114 | 50-150 | H | 107 | 50-150 |
| 13C8_PFOS | | 109 | 50-150 | | 112 | 50-150 | H | 92 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-014
Description: CMT-VRTB-01_7_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1910
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 127 | 50-150 | | 137 | 50-150 | H | 107 | 50-150 |
| 13C9_PFNA | | 105 | 50-150 | | 112 | 50-150 | H | 92 | 50-150 |
| d5-EtFOSAA | | 98 | 50-150 | | 101 | 50-150 | H | 98 | 50-150 |
| d-MeFOSA | | 86 | 50-150 | | 106 | 50-150 | H | 79 | 50-150 |
| d3-MeFOSAA | | 120 | 50-150 | | 115 | 50-150 | H | 99 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-014
Description: CMT-VRTB-01_7_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1910 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/08/2022 2052 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 07/11/2022 1351 | MMM | 07/05/2022 0855 | 47073 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/15/2022 1344 | MMM | 07/13/2022 1216 | 47821 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 5.9 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 8.3 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 5.1 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 150 | | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 9.1 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 9.3 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 13 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.2 | J | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 10 | BJ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 660 | | 17 | 8.5 | 4.3 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 150 | 50-150 | | 138 | 50-150 | H | 115 | 50-150 |
| 13C2_6:2FTS | N | 161 | 50-150 | | 144 | 50-150 | HN | 159 | 50-150 |
| 13C2_8:2FTS | | 122 | 50-150 | | 136 | 50-150 | H | 94 | 50-150 |
| 13C2_PFDoA | | 98 | 50-150 | | 104 | 50-150 | H | 95 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 | | 84 | 50-150 | H | 95 | 50-150 |
| 13C3_PFBS | | 116 | 50-150 | | 124 | 50-150 | H | 107 | 50-150 |
| 13C3_PFHxS | | 114 | 50-150 | | 119 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 | | 119 | 50-150 | H | 96 | 50-150 |
| 13C4_PFHpA | | 113 | 50-150 | | 114 | 50-150 | H | 100 | 50-150 |
| 13C5_PFHxA | | 120 | 50-150 | | 119 | 50-150 | H | 106 | 50-150 |
| 13C5_PFPeA | | 112 | 50-150 | | 118 | 50-150 | H | 107 | 50-150 |
| 13C6_PFDA | | 108 | 50-150 | | 110 | 50-150 | H | 99 | 50-150 |
| 13C7_PFUdA | | 108 | 50-150 | | 107 | 50-150 | H | 102 | 50-150 |
| 13C8_PFOA | | 116 | 50-150 | | 114 | 50-150 | H | 107 | 50-150 |
| 13C8_PFOS | | 109 | 50-150 | | 112 | 50-150 | H | 92 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-014
Description: CMT-VRTB-01_7_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1910
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 127 | 50-150 | | 137 | 50-150 | H | 107 | 50-150 |
| 13C9_PFNA | | 105 | 50-150 | | 112 | 50-150 | H | 92 | 50-150 |
| d5-EtFOSAA | | 98 | 50-150 | | 101 | 50-150 | H | 98 | 50-150 |
| d-MeFOSA | | 86 | 50-150 | | 106 | 50-150 | H | 79 | 50-150 |
| d3-MeFOSAA | | 120 | 50-150 | | 115 | 50-150 | H | 99 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-014
Description: CMT-VRTB-01_7_06152022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1910 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/08/2022 2052 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 07/11/2022 1351 | MMM | 07/05/2022 0855 | 47073 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/15/2022 1344 | MMM | 07/13/2022 1216 | 47821 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UHQ | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.4 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | UH | 6.8 | 3.4 | 1.7 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 5.4 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.3 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 4.6 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 130 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.9 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 7.3 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 11 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 6.5 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 15 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 6.6 | H | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.85 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 590 | HE | 3.4 | 1.7 | 0.85 | ng/L | 3 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 150 | 50-150 | | 138 | 50-150 | H | 115 | 50-150 |
| 13C2_6:2FTS | N | 161 | 50-150 | | 144 | 50-150 | HN | 159 | 50-150 |
| 13C2_8:2FTS | | 122 | 50-150 | | 136 | 50-150 | H | 94 | 50-150 |
| 13C2_PFDoA | | 98 | 50-150 | | 104 | 50-150 | H | 95 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 | | 84 | 50-150 | H | 95 | 50-150 |
| 13C3_PFBS | | 116 | 50-150 | | 124 | 50-150 | H | 107 | 50-150 |
| 13C3_PFHxS | | 114 | 50-150 | | 119 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 | | 119 | 50-150 | H | 96 | 50-150 |
| 13C4_PFHpA | | 113 | 50-150 | | 114 | 50-150 | H | 100 | 50-150 |
| 13C5_PFHxA | | 120 | 50-150 | | 119 | 50-150 | H | 106 | 50-150 |
| 13C5_PFPeA | | 112 | 50-150 | | 118 | 50-150 | H | 107 | 50-150 |
| 13C6_PFDA | | 108 | 50-150 | | 110 | 50-150 | H | 99 | 50-150 |
| 13C7_PFUdA | | 108 | 50-150 | | 107 | 50-150 | H | 102 | 50-150 |
| 13C8_PFOA | | 116 | 50-150 | | 114 | 50-150 | H | 107 | 50-150 |
| 13C8_PFOS | | 109 | 50-150 | | 112 | 50-150 | H | 92 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-014
Description: CMT-VRTB-01_7_06152022
Matrix: Aqueous
Date Sampled: 06/14/2022 1910
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 127 | 50-150 | | 137 | 50-150 | H | 107 | 50-150 |
| 13C9_PFNA | | 105 | 50-150 | | 112 | 50-150 | H | 92 | 50-150 |
| d5-EtFOSAA | | 98 | 50-150 | | 101 | 50-150 | H | 98 | 50-150 |
| d-MeFOSA | | 86 | 50-150 | | 106 | 50-150 | H | 79 | 50-150 |
| d3-MeFOSAA | | 120 | 50-150 | | 115 | 50-150 | H | 99 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-015
Description: VRTB-S-M5_06162022 | Matrix: Aqueous
Date Sampled: 06/14/2022 0905 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/08/2022 2103 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 07/11/2022 1402 | MMM | 07/05/2022 0855 | 47073 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/18/2022 1230 | MMM | 07/14/2022 1242 | 47961 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 5.5 | J | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 20 | Q | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 6.0 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 17 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 3.1 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 9.7 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 320 | E | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 25 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 39 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 58 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 10 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 46 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 57 | B | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2600 | E | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 159 | 50-150 | | 107 | 50-150 | H | 114 | 50-150 |
| 13C2_6:2FTS | N | 153 | 50-150 | | 110 | 50-150 | H | 118 | 50-150 |
| 13C2_8:2FTS | | 115 | 50-150 | | 88 | 50-150 | H | 87 | 50-150 |
| 13C2_PFDoA | | 52 | 50-150 | N | 41 | 50-150 | H | 76 | 50-150 |
| 13C2_PFTeDA | N | 26 | 50-150 | N | 23 | 50-150 | H | 63 | 50-150 |
| 13C3_PFBS | | 111 | 50-150 | | 89 | 50-150 | H | 86 | 50-150 |
| 13C3_PFHxS | | 112 | 50-150 | | 88 | 50-150 | H | 83 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 | | 95 | 50-150 | H | 76 | 50-150 |
| 13C4_PFHpA | | 109 | 50-150 | | 96 | 50-150 | H | 79 | 50-150 |
| 13C5_PFHxA | | 114 | 50-150 | | 94 | 50-150 | H | 85 | 50-150 |
| 13C5_PFPeA | | 108 | 50-150 | | 92 | 50-150 | H | 86 | 50-150 |
| 13C6_PFDA | | 104 | 50-150 | | 86 | 50-150 | H | 86 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 | | 71 | 50-150 | H | 76 | 50-150 |
| 13C8_PFOA | | 111 | 50-150 | | 90 | 50-150 | H | 81 | 50-150 |
| 13C8_PFOS | | 90 | 50-150 | | 91 | 50-150 | H | 74 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-015
Description: VRTB-S-M5_06162022
Matrix: Aqueous
Date Sampled: 06/14/2022 0905
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 130 | 50-150 | | 111 | 50-150 | H | 85 | 50-150 |
| 13C9_PFNA | | 91 | 50-150 | | 91 | 50-150 | H | 69 | 50-150 |
| d5-EtFOSAA | | 87 | 50-150 | | 70 | 50-150 | H | 92 | 50-150 |
| d-MeFOSA | | 61 | 50-150 | | 56 | 50-150 | H | 58 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 | | 91 | 50-150 | H | 91 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-015
Description: VRTB-S-M5_06162022 | Matrix: Aqueous
Date Sampled: 06/14/2022 0905 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/08/2022 2103 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 07/11/2022 1402 | MMM | 07/05/2022 0855 | 47073 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/18/2022 1230 | MMM | 07/14/2022 1242 | 47961 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 70 | U | 140 | 70 | 35 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 70 | U | 140 | 70 | 35 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 70 | U | 140 | 70 | 35 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 70 | U | 140 | 70 | 35 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 140 | U | 280 | 140 | 69 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 70 | U | 140 | 70 | 35 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 22 | J | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 330 | | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 25 | J | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 35 | UQ | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 41 | J | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 57 | J | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 49 | J | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 57 | BJ | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 35 | UQ | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 35 | UQ | 69 | 35 | 17 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 35 | U | 69 | 35 | 17 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2400 | | 69 | 35 | 17 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 159 | 50-150 | | 107 | 50-150 | H | 114 | 50-150 |
| 13C2_6:2FTS | N | 153 | 50-150 | | 110 | 50-150 | H | 118 | 50-150 |
| 13C2_8:2FTS | | 115 | 50-150 | | 88 | 50-150 | H | 87 | 50-150 |
| 13C2_PFDoA | | 52 | 50-150 | N | 41 | 50-150 | H | 76 | 50-150 |
| 13C2_PFTeDA | N | 26 | 50-150 | N | 23 | 50-150 | H | 63 | 50-150 |
| 13C3_PFBS | | 111 | 50-150 | | 89 | 50-150 | H | 86 | 50-150 |
| 13C3_PFHxS | | 112 | 50-150 | | 88 | 50-150 | H | 83 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 | | 95 | 50-150 | H | 76 | 50-150 |
| 13C4_PFHpA | | 109 | 50-150 | | 96 | 50-150 | H | 79 | 50-150 |
| 13C5_PFHxA | | 114 | 50-150 | | 94 | 50-150 | H | 85 | 50-150 |
| 13C5_PFPeA | | 108 | 50-150 | | 92 | 50-150 | H | 86 | 50-150 |
| 13C6_PFDA | | 104 | 50-150 | | 86 | 50-150 | H | 86 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 | | 71 | 50-150 | H | 76 | 50-150 |
| 13C8_PFOA | | 111 | 50-150 | | 90 | 50-150 | H | 81 | 50-150 |
| 13C8_PFOS | | 90 | 50-150 | | 91 | 50-150 | H | 74 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-015
Description: VRTB-S-M5_06162022
Matrix: Aqueous
Date Sampled: 06/14/2022 0905
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 130 | 50-150 | | 111 | 50-150 | H | 85 | 50-150 |
| 13C9_PFNA | | 91 | 50-150 | | 91 | 50-150 | H | 69 | 50-150 |
| d5-EtFOSAA | | 87 | 50-150 | | 70 | 50-150 | H | 92 | 50-150 |
| d-MeFOSA | | 61 | 50-150 | | 56 | 50-150 | H | 58 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 | | 91 | 50-150 | H | 91 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-015
Description: VRTB-S-M5_06162022 | Matrix: Aqueous
Date Sampled: 06/14/2022 0905 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/08/2022 2103 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 20 | 07/11/2022 1402 | MMM | 07/05/2022 0855 | 47073 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/18/2022 1230 | MMM | 07/14/2022 1242 | 47961 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.6 | HJ | 7.1 | 3.6 | 1.8 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 19 | H | 7.1 | 3.6 | 1.8 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.6 | UH | 7.1 | 3.6 | 1.8 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | UH | 7.1 | 3.6 | 1.8 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.6 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | UH | 7.1 | 3.6 | 1.8 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 5.8 | H | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 17 | H | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 8.5 | H | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 310 | H | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 24 | H | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 40 | H | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 57 | H | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 11 | H | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 43 | H | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 50 | H | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | UH | 3.6 | 1.8 | 0.89 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2400 | HE | 3.6 | 1.8 | 0.89 | ng/L | 3 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 159 | 50-150 | | 107 | 50-150 | H | 114 | 50-150 |
| 13C2_6:2FTS | N | 153 | 50-150 | | 110 | 50-150 | H | 118 | 50-150 |
| 13C2_8:2FTS | | 115 | 50-150 | | 88 | 50-150 | H | 87 | 50-150 |
| 13C2_PFDoA | | 52 | 50-150 | N | 41 | 50-150 | H | 76 | 50-150 |
| 13C2_PFTeDA | N | 26 | 50-150 | N | 23 | 50-150 | H | 63 | 50-150 |
| 13C3_PFBS | | 111 | 50-150 | | 89 | 50-150 | H | 86 | 50-150 |
| 13C3_PFHxS | | 112 | 50-150 | | 88 | 50-150 | H | 83 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 | | 95 | 50-150 | H | 76 | 50-150 |
| 13C4_PFHpA | | 109 | 50-150 | | 96 | 50-150 | H | 79 | 50-150 |
| 13C5_PFHxA | | 114 | 50-150 | | 94 | 50-150 | H | 85 | 50-150 |
| 13C5_PFPeA | | 108 | 50-150 | | 92 | 50-150 | H | 86 | 50-150 |
| 13C6_PFDA | | 104 | 50-150 | | 86 | 50-150 | H | 86 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 | | 71 | 50-150 | H | 76 | 50-150 |
| 13C8_PFOA | | 111 | 50-150 | | 90 | 50-150 | H | 81 | 50-150 |
| 13C8_PFOS | | 90 | 50-150 | | 91 | 50-150 | H | 74 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-015
Description: VRTB-S-M5_06162022
Matrix: Aqueous
Date Sampled: 06/14/2022 0905
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 130 | 50-150 | | 111 | 50-150 | H | 85 | 50-150 |
| 13C9_PFNA | | 91 | 50-150 | | 91 | 50-150 | H | 69 | 50-150 |
| d5-EtFOSAA | | 87 | 50-150 | | 70 | 50-150 | H | 92 | 50-150 |
| d-MeFOSA | | 61 | 50-150 | | 56 | 50-150 | H | 58 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 | | 91 | 50-150 | H | 91 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-016
Description: VRTB-S-06_06162022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1025 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/08/2022 2114 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 07/11/2022 1413 | MMM | 07/05/2022 0855 | 47073 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 17 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 29 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 3.6 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 34 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 520 | | 34 | 17 | 8.4 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 15 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 0.97 | J | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 25 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 46 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 8.0 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 40 | | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 23 | B | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.84 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1900 | | 34 | 17 | 8.4 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 137 | 50-150 | | 112 | 50-150 |
| 13C2_6:2FTS | N | 180 | 50-150 | | 113 | 50-150 |
| 13C2_8:2FTS | | 110 | 50-150 | | 105 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 | | 78 | 50-150 |
| 13C2_PFTeDA | | 55 | 50-150 | | 54 | 50-150 |
| 13C3_PFBS | | 107 | 50-150 | | 97 | 50-150 |
| 13C3_PFHxS | | 98 | 50-150 | | 96 | 50-150 |
| 13C4_PFBA | | 91 | 50-150 | | 98 | 50-150 |
| 13C4_PFHpA | | 89 | 50-150 | | 97 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 | | 96 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 | | 93 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 | | 94 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 | | 89 | 50-150 |
| 13C8_PFOA | | 105 | 50-150 | | 98 | 50-150 |
| 13C8_PFOS | | 82 | 50-150 | | 90 | 50-150 |
| 13C8_PFOSA | | 127 | 50-150 | | 107 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-016
Description: VRTB-S-06_06162022
Matrix: Aqueous
Date Sampled: 06/14/2022 1025
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 85 | 50-150 | | 90 | 50-150 |
| d5-EtFOSAA | | 84 | 50-150 | | 75 | 50-150 |
| d-MeFOSA | | 71 | 50-150 | | 63 | 50-150 |
| d3-MeFOSAA | | 97 | 50-150 | | 93 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-017
Description: VRTB-S-R7_06162022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1120 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/11/2022 1446 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 07/12/2022 1219 | MMM | 07/05/2022 0855 | 47073 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 37 | | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 89 | | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 44 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 140 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.0 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 89 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1900 | | 350 | 180 | 87 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 62 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 150 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 310 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 76 | Q | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 230 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 150 | B | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 16000 | | 350 | 180 | 87 | ng/L | 2 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 143 | 50-150 | | 121 | 50-150 |
| 13C2_6:2FTS | | 118 | 50-150 | | 111 | 50-150 |
| 13C2_8:2FTS | | 106 | 50-150 | | 109 | 50-150 |
| 13C2_PFDoA | | 65 | 50-150 | | 113 | 50-150 |
| 13C2_PFTeDA | N | 46 | 50-150 | | 112 | 50-150 |
| 13C3_PFBS | | 104 | 50-150 | | 112 | 50-150 |
| 13C3_PFHxS | | 76 | 50-150 | | 113 | 50-150 |
| 13C4_PFBA | | 85 | 50-150 | | 114 | 50-150 |
| 13C4_PFHpA | | 83 | 50-150 | | 109 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 | | 110 | 50-150 |
| 13C5_PFPeA | | 94 | 50-150 | | 112 | 50-150 |
| 13C6_PFDA | | 85 | 50-150 | | 113 | 50-150 |
| 13C7_PFUdA | | 79 | 50-150 | | 110 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 | | 116 | 50-150 |
| 13C8_PFOS | N | 42 | 50-150 | | 113 | 50-150 |
| 13C8_PFOSA | | 107 | 50-150 | | 126 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-017
Description: VRTB-S-R7_06162022
Matrix: Aqueous
Date Sampled: 06/14/2022 1120
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | N | 40 | 50-150 | | 111 | 50-150 |
| d5-EtFOSAA | | 68 | 50-150 | | 115 | 50-150 |
| d-MeFOSA | | 66 | 50-150 | | 122 | 50-150 |
| d3-MeFOSAA | | 86 | 50-150 | | 116 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-018
Description: VRTB-S-P8_06162022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1215 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/11/2022 1457 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 07/12/2022 1230 | MMM | 07/05/2022 0855 | 47073 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/15/2022 1355 | MMM | 07/13/2022 1216 | 47821 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 6.5 | J | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 21 | | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 17 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 63 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.3 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 32 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 950 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 19 | Q | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 32 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 96 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 22 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 64 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 34 | B | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 12000 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 132 | 50-150 | | 105 | 50-150 | H | 92 | 50-150 |
| 13C2_6:2FTS | | 132 | 50-150 | | 104 | 50-150 | H | 96 | 50-150 |
| 13C2_8:2FTS | | 106 | 50-150 | | 105 | 50-150 | H | 64 | 50-150 |
| 13C2_PFDoA | | 61 | 50-150 | | 102 | 50-150 | HN | 47 | 50-150 |
| 13C2_PFTeDA | N | 40 | 50-150 | | 102 | 50-150 | HN | 44 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 | | 103 | 50-150 | H | 79 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 | | 101 | 50-150 | H | 67 | 50-150 |
| 13C4_PFBA | N | 49 | 50-150 | | 103 | 50-150 | H | 51 | 50-150 |
| 13C4_PFHpA | | 89 | 50-150 | | 106 | 50-150 | H | 72 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 | | 99 | 50-150 | H | 77 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 | | 104 | 50-150 | H | 77 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 | | 101 | 50-150 | H | 66 | 50-150 |
| 13C7_PFUdA | | 82 | 50-150 | | 99 | 50-150 | H | 59 | 50-150 |
| 13C8_PFOA | | 95 | 50-150 | | 103 | 50-150 | H | 75 | 50-150 |
| 13C8_PFOS | | 51 | 50-150 | | 100 | 50-150 | HN | 44 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-018
Description: VRTB-S-P8_06162022
Matrix: Aqueous
Date Sampled: 06/14/2022 1215
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 102 | 50-150 | | 111 | 50-150 | H | 80 | 50-150 |
| 13C9_PFNA | | 54 | 50-150 | | 98 | 50-150 | HN | 46 | 50-150 |
| d5-EtFOSAA | | 69 | 50-150 | | 108 | 50-150 | H | 53 | 50-150 |
| d-MeFOSA | | 92 | 50-150 | | 105 | 50-150 | H | 71 | 50-150 |
| d3-MeFOSAA | | 90 | 50-150 | | 104 | 50-150 | H | 58 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-018
Description: VRTB-S-P8_06162022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1215 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/11/2022 1457 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 07/12/2022 1230 | MMM | 07/05/2022 0855 | 47073 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/15/2022 1355 | MMM | 07/13/2022 1216 | 47821 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 700 | U | 1400 | 700 | 340 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 720 | | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 88 | J | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 88 | J | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 7300 | | 340 | 170 | 86 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 132 | 50-150 | | 105 | 50-150 | H | 92 | 50-150 |
| 13C2_6:2FTS | | 132 | 50-150 | | 104 | 50-150 | H | 96 | 50-150 |
| 13C2_8:2FTS | | 106 | 50-150 | | 105 | 50-150 | H | 64 | 50-150 |
| 13C2_PFDoA | | 61 | 50-150 | | 102 | 50-150 | HN | 47 | 50-150 |
| 13C2_PFTeDA | N | 40 | 50-150 | | 102 | 50-150 | HN | 44 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 | | 103 | 50-150 | H | 79 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 | | 101 | 50-150 | H | 67 | 50-150 |
| 13C4_PFBA | N | 49 | 50-150 | | 103 | 50-150 | H | 51 | 50-150 |
| 13C4_PFHpA | | 89 | 50-150 | | 106 | 50-150 | H | 72 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 | | 99 | 50-150 | H | 77 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 | | 104 | 50-150 | H | 77 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 | | 101 | 50-150 | H | 66 | 50-150 |
| 13C7_PFUdA | | 82 | 50-150 | | 99 | 50-150 | H | 59 | 50-150 |
| 13C8_PFOA | | 95 | 50-150 | | 103 | 50-150 | H | 75 | 50-150 |
| 13C8_PFOS | | 51 | 50-150 | | 100 | 50-150 | HN | 44 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-018
Description: VRTB-S-P8_06162022
Matrix: Aqueous
Date Sampled: 06/14/2022 1215
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 102 | 50-150 | | 111 | 50-150 | H | 80 | 50-150 |
| 13C9_PFNA | | 54 | 50-150 | | 98 | 50-150 | HN | 46 | 50-150 |
| d5-EtFOSAA | | 69 | 50-150 | | 108 | 50-150 | H | 53 | 50-150 |
| d-MeFOSA | | 92 | 50-150 | | 105 | 50-150 | H | 71 | 50-150 |
| d3-MeFOSAA | | 90 | 50-150 | | 104 | 50-150 | H | 58 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XF17016-018
Description: VRTB-S-P8_06162022 | Matrix: Aqueous
Date Sampled: 06/14/2022 1215 | Project Name: ESTCP Vertebrae
Date Received: 06/17/2022 | Project Number: 30027244.00001

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/11/2022 1457 | MMM | 07/05/2022 0855 | 47073 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 07/12/2022 1230 | MMM | 07/05/2022 0855 | 47073 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 07/15/2022 1355 | MMM | 07/13/2022 1216 | 47821 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 8.7 | HJ | 9.7 | 4.9 | 2.4 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 27 | H | 9.7 | 4.9 | 2.4 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.9 | UH | 9.7 | 4.9 | 2.4 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.9 | UH | 9.7 | 4.9 | 2.4 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 9.5 | UH | 19 | 9.5 | 4.8 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.9 | UH | 9.7 | 4.9 | 2.4 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 20 | H | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.4 | UHQ | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 77 | H | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.4 | UHQ | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.6 | HJ | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 36 | H | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1200 | HE | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 22 | H | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.4 | UH | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.4 | UHQ | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 37 | H | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 110 | H | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 27 | HQ | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 79 | H | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 37 | H | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.4 | UHQ | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.4 | UHQ | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.4 | UH | 4.8 | 2.4 | 1.2 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 14000 | HEQ | 4.8 | 2.4 | 1.2 | ng/L | 3 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits | Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 132 | 50-150 | | 105 | 50-150 | H | 92 | 50-150 |
| 13C2_6:2FTS | | 132 | 50-150 | | 104 | 50-150 | H | 96 | 50-150 |
| 13C2_8:2FTS | | 106 | 50-150 | | 105 | 50-150 | H | 64 | 50-150 |
| 13C2_PFDoA | | 61 | 50-150 | | 102 | 50-150 | HN | 47 | 50-150 |
| 13C2_PFTeDA | N | 40 | 50-150 | | 102 | 50-150 | HN | 44 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 | | 103 | 50-150 | H | 79 | 50-150 |
| 13C3_PFHxS | | 85 | 50-150 | | 101 | 50-150 | H | 67 | 50-150 |
| 13C4_PFBA | N | 49 | 50-150 | | 103 | 50-150 | H | 51 | 50-150 |
| 13C4_PFHpA | | 89 | 50-150 | | 106 | 50-150 | H | 72 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 | | 99 | 50-150 | H | 77 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 | | 104 | 50-150 | H | 77 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 | | 101 | 50-150 | H | 66 | 50-150 |
| 13C7_PFUdA | | 82 | 50-150 | | 99 | 50-150 | H | 59 | 50-150 |
| 13C8_PFOA | | 95 | 50-150 | | 103 | 50-150 | H | 75 | 50-150 |
| 13C8_PFOS | | 51 | 50-150 | | 100 | 50-150 | HN | 44 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XF17016-018
Description: VRTB-S-P8_06162022
Matrix: Aqueous
Date Sampled: 06/14/2022 1215
Project Name: ESTCP Vertebrae
Date Received: 06/17/2022
Project Number: 30027244.00001

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 102 | 50-150 | | 111 | 50-150 | H | 80 | 50-150 |
| 13C9_PFNA | | 54 | 50-150 | | 98 | 50-150 | HN | 46 | 50-150 |
| d5-EtFOSAA | | 69 | 50-150 | | 108 | 50-150 | H | 53 | 50-150 |
| d-MeFOSA | | 92 | 50-150 | | 105 | 50-150 | H | 71 | 50-150 |
| d3-MeFOSAA | | 90 | 50-150 | | 104 | 50-150 | H | 58 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: XQ47070-001
Batch: 47070
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/05/2022 0909

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/07/2022 1758 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/07/2022 1758 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/07/2022 1758 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/07/2022 1758 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 07/07/2022 1758 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/07/2022 1758 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFBA | 1.4 | J | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFPeA | 4.2 | | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/07/2022 1758 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 95 | 50-150 |
| 13C2_6:2FTS | | 98 | 50-150 |
| 13C2_8:2FTS | | 89 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 74 | 50-150 |
| 13C3_PFBS | | 80 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 |
| 13C4_PFHpA | | 85 | 50-150 |
| 13C5_PFHxA | | 82 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 92 | 50-150 |
| 13C7_PFUdA | | 96 | 50-150 |
| 13C8_PFOA | | 87 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47070-001
Batch: 47070
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/05/2022 0909

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 92 | 50-150 |
| 13C8_PFOSA | | 106 | 50-150 |
| 13C9_PFNA | | 90 | 50-150 |
| d5-EtFOSAA | | 62 | 50-150 |
| d-MeFOSA | | 77 | 50-150 |
| d3-MeFOSAA | | 99 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47070-002
Batch: 47070
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/05/2022 0909

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 14 | | 1 | 94 | 67-138 | 07/07/2022 1809 |
| 6:2 FTS | 15 | 15 | | 1 | 98 | 64-140 | 07/07/2022 1809 |
| 4:2 FTS | 15 | 14 | | 1 | 97 | 63-143 | 07/07/2022 1809 |
| EtFOSAA | 16 | 14 | | 1 | 89 | 61-135 | 07/07/2022 1809 |
| MeFOSA | 16 | 18 | | 1 | 113 | 68-141 | 07/07/2022 1809 |
| MeFOSAA | 16 | 14 | | 1 | 88 | 65-136 | 07/07/2022 1809 |
| PFBS | 14 | 16 | | 1 | 115 | 72-130 | 07/07/2022 1809 |
| PFDS | 15 | 15 | | 1 | 97 | 53-142 | 07/07/2022 1809 |
| PFHpS | 15 | 17 | | 1 | 109 | 69-134 | 07/07/2022 1809 |
| PFNS | 15 | 16 | | 1 | 102 | 69-127 | 07/07/2022 1809 |
| PFOSA | 16 | 15 | | 1 | 92 | 67-137 | 07/07/2022 1809 |
| PFPeS | 15 | 18 | | 1 | 122 | 71-127 | 07/07/2022 1809 |
| PFHxS | 15 | 16 | | 1 | 110 | 68-131 | 07/07/2022 1809 |
| PFBA | 16 | 18 | | 1 | 113 | 73-129 | 07/07/2022 1809 |
| PFDA | 16 | 17 | | 1 | 107 | 71-129 | 07/07/2022 1809 |
| PFDoA | 16 | 17 | | 1 | 107 | 72-134 | 07/07/2022 1809 |
| PFHpA | 16 | 16 | | 1 | 98 | 72-130 | 07/07/2022 1809 |
| PFHxA | 16 | 17 | | 1 | 108 | 72-129 | 07/07/2022 1809 |
| PFNA | 16 | 15 | | 1 | 97 | 69-130 | 07/07/2022 1809 |
| PFOA | 16 | 18 | | 1 | 111 | 71-133 | 07/07/2022 1809 |
| PFPeA | 16 | 20 | | 1 | 123 | 72-129 | 07/07/2022 1809 |
| PFTeDA | 16 | 16 | | 1 | 100 | 71-132 | 07/07/2022 1809 |
| PFTrDA | 16 | 17 | | 1 | 108 | 65-144 | 07/07/2022 1809 |
| PFUdA | 16 | 18 | | 1 | 111 | 69-133 | 07/07/2022 1809 |
| PFOS | 15 | 15 | | 1 | 98 | 65-140 | 07/07/2022 1809 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 |
| 13C2_6:2FTS | | 127 | 50-150 |
| 13C2_8:2FTS | | 104 | 50-150 |
| 13C2_PFDoA | | 90 | 50-150 |
| 13C2_PFTeDA | | 86 | 50-150 |
| 13C3_PFBS | | 78 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 104 | 50-150 |
| 13C4_PFHpA | | 105 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 98 | 50-150 |
| 13C6_PFDA | | 110 | 50-150 |
| 13C7_PFUdA | | 97 | 50-150 |
| 13C8_PFOA | | 100 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47070-002
Batch: 47070
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/05/2022 0909

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 104 | 50-150 |
| 13C8_PFOSA | | 119 | 50-150 |
| 13C9_PFNA | | 116 | 50-150 |
| d5-EtFOSAA | | 89 | 50-150 |
| d-MeFOSA | | 83 | 50-150 |
| d3-MeFOSAA | | 97 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47073-001
Batch: 47073
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/05/2022 0855

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/08/2022 1702 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/08/2022 1702 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/08/2022 1702 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/08/2022 1702 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 07/08/2022 1702 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/08/2022 1702 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFPeA | 2.4 | J | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/08/2022 1702 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 110 | 50-150 |
| 13C2_6:2FTS | | 125 | 50-150 |
| 13C2_8:2FTS | | 103 | 50-150 |
| 13C2_PFDoA | | 89 | 50-150 |
| 13C2_PFTeDA | | 80 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 94 | 50-150 |
| 13C4_PFHpA | | 89 | 50-150 |
| 13C5_PFHxA | | 99 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47073-001
Batch: 47073
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/05/2022 0855

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 102 | 50-150 |
| 13C9_PFNA | | 92 | 50-150 |
| d5-EtFOSAA | | 83 | 50-150 |
| d-MeFOSA | | 71 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47073-002
Batch: 47073
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/05/2022 0855

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 15 | | 1 | 99 | 67-138 | 07/08/2022 1713 |
| 6:2 FTS | 15 | 16 | | 1 | 107 | 64-140 | 07/08/2022 1713 |
| 4:2 FTS | 15 | 15 | | 1 | 102 | 63-143 | 07/08/2022 1713 |
| EtFOSAA | 16 | 17 | | 1 | 107 | 61-135 | 07/08/2022 1713 |
| MeFOSA | 16 | 16 | | 1 | 103 | 68-141 | 07/08/2022 1713 |
| MeFOSAA | 16 | 15 | | 1 | 92 | 65-136 | 07/08/2022 1713 |
| PFBS | 14 | 15 | | 1 | 104 | 72-130 | 07/08/2022 1713 |
| PFDS | 15 | 17 | | 1 | 110 | 53-142 | 07/08/2022 1713 |
| PFHpS | 15 | 17 | | 1 | 113 | 69-134 | 07/08/2022 1713 |
| PFNS | 15 | 16 | | 1 | 104 | 69-127 | 07/08/2022 1713 |
| PFOSA | 16 | 15 | | 1 | 93 | 67-137 | 07/08/2022 1713 |
| PFPeS | 15 | 16 | | 1 | 107 | 71-127 | 07/08/2022 1713 |
| PFHxS | 15 | 15 | | 1 | 102 | 68-131 | 07/08/2022 1713 |
| PFBA | 16 | 17 | | 1 | 105 | 73-129 | 07/08/2022 1713 |
| PFDA | 16 | 17 | | 1 | 104 | 71-129 | 07/08/2022 1713 |
| PFDoA | 16 | 17 | | 1 | 107 | 72-134 | 07/08/2022 1713 |
| PFHpA | 16 | 19 | | 1 | 117 | 72-130 | 07/08/2022 1713 |
| PFHxA | 16 | 17 | | 1 | 105 | 72-129 | 07/08/2022 1713 |
| PFNA | 16 | 17 | | 1 | 107 | 69-130 | 07/08/2022 1713 |
| PFOA | 16 | 16 | | 1 | 102 | 71-133 | 07/08/2022 1713 |
| PFPeA | 16 | 20 | | 1 | 124 | 72-129 | 07/08/2022 1713 |
| PFTeDA | 16 | 17 | | 1 | 105 | 71-132 | 07/08/2022 1713 |
| PFTrDA | 16 | 16 | | 1 | 100 | 65-144 | 07/08/2022 1713 |
| PFUdA | 16 | 16 | | 1 | 100 | 69-133 | 07/08/2022 1713 |
| PFOS | 15 | 15 | | 1 | 104 | 65-140 | 07/08/2022 1713 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 |
| 13C2_6:2FTS | | 116 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 |
| 13C2_PFDoA | | 90 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 |
| 13C3_PFBS | | 92 | 50-150 |
| 13C3_PFHxS | | 89 | 50-150 |
| 13C4_PFBA | | 91 | 50-150 |
| 13C4_PFHpA | | 85 | 50-150 |
| 13C5_PFHxA | | 98 | 50-150 |
| 13C5_PFPeA | | 88 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 |
| 13C8_PFOA | | 94 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47073-002
Batch: 47073
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/05/2022 0855

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 87 | 50-150 |
| 13C8_PFOSA | | 96 | 50-150 |
| 13C9_PFNA | | 89 | 50-150 |
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 70 | 50-150 |
| d3-MeFOSAA | | 95 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47309-001
Batch: 47309
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/07/2022 1706

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/10/2022 1611 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/10/2022 1611 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/10/2022 1611 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/10/2022 1611 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 07/10/2022 1611 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/10/2022 1611 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/10/2022 1611 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 118 | 50-150 |
| 13C2_6:2FTS | N | 151 | 50-150 |
| 13C2_8:2FTS | | 122 | 50-150 |
| 13C2_PFDoA | | 108 | 50-150 |
| 13C2_PFTeDA | | 98 | 50-150 |
| 13C3_PFBS | | 107 | 50-150 |
| 13C3_PFHxS | | 105 | 50-150 |
| 13C4_PFBA | | 108 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 |
| 13C5_PFHxA | | 108 | 50-150 |
| 13C5_PFPeA | | 99 | 50-150 |
| 13C6_PFDA | | 97 | 50-150 |
| 13C7_PFUdA | | 107 | 50-150 |
| 13C8_PFOA | | 102 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47309-001
Batch: 47309
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/07/2022 1706

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 104 | 50-150 |
| 13C8_PFOSA | | 109 | 50-150 |
| 13C9_PFNA | | 93 | 50-150 |
| d5-EtFOSAA | | 101 | 50-150 |
| d-MeFOSA | | 56 | 50-150 |
| d3-MeFOSAA | | 105 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47309-002
Batch: 47309
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/07/2022 1706

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 15 | | 1 | 96 | 67-138 | 07/10/2022 1622 |
| 6:2 FTS | 15 | 14 | | 1 | 91 | 64-140 | 07/10/2022 1622 |
| 4:2 FTS | 15 | 16 | | 1 | 107 | 63-143 | 07/10/2022 1622 |
| EtFOSAA | 16 | 16 | | 1 | 99 | 61-135 | 07/10/2022 1622 |
| MeFOSA | 16 | 17 | | 1 | 105 | 68-141 | 07/10/2022 1622 |
| MeFOSAA | 16 | 16 | | 1 | 98 | 65-136 | 07/10/2022 1622 |
| PFBS | 14 | 14 | | 1 | 101 | 72-130 | 07/10/2022 1622 |
| PFDS | 15 | 16 | | 1 | 105 | 53-142 | 07/10/2022 1622 |
| PFHpS | 15 | 16 | | 1 | 103 | 69-134 | 07/10/2022 1622 |
| PFNS | 15 | 16 | | 1 | 106 | 69-127 | 07/10/2022 1622 |
| PFOSA | 16 | 12 | | 1 | 74 | 67-137 | 07/10/2022 1622 |
| PFPeS | 15 | 16 | | 1 | 106 | 71-127 | 07/10/2022 1622 |
| PFHxS | 15 | 14 | | 1 | 94 | 68-131 | 07/10/2022 1622 |
| PFBA | 16 | 17 | | 1 | 107 | 73-129 | 07/10/2022 1622 |
| PFDA | 16 | 16 | | 1 | 101 | 71-129 | 07/10/2022 1622 |
| PFDoA | 16 | 17 | | 1 | 106 | 72-134 | 07/10/2022 1622 |
| PFHpA | 16 | 14 | | 1 | 85 | 72-130 | 07/10/2022 1622 |
| PFHxA | 16 | 15 | | 1 | 96 | 72-129 | 07/10/2022 1622 |
| PFNA | 16 | 15 | | 1 | 94 | 69-130 | 07/10/2022 1622 |
| PFOA | 16 | 16 | | 1 | 102 | 71-133 | 07/10/2022 1622 |
| PFPeA | 16 | 16 | | 1 | 101 | 72-129 | 07/10/2022 1622 |
| PFTeDA | 16 | 16 | | 1 | 99 | 71-132 | 07/10/2022 1622 |
| PFTrDA | 16 | 16 | | 1 | 102 | 65-144 | 07/10/2022 1622 |
| PFUdA | 16 | 15 | | 1 | 93 | 69-133 | 07/10/2022 1622 |
| PFOS | 15 | 14 | | 1 | 95 | 65-140 | 07/10/2022 1622 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 97 | 50-150 |
| 13C2_6:2FTS | N | 200 | 50-150 |
| 13C2_8:2FTS | | 113 | 50-150 |
| 13C2_PFDoA | | 80 | 50-150 |
| 13C2_PFTeDA | | 90 | 50-150 |
| 13C3_PFBS | | 91 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 92 | 50-150 |
| 13C4_PFHpA | | 96 | 50-150 |
| 13C5_PFHxA | | 95 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47309-002
Batch: 47309
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/07/2022 1706

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 116 | 50-150 |
| 13C9_PFNA | | 94 | 50-150 |
| d5-EtFOSAA | | 91 | 50-150 |
| d-MeFOSA | | 66 | 50-150 |
| d3-MeFOSAA | | 94 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCSD

Sample ID: XQ47309-003
Batch: 47309
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/07/2022 1706

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 14 | | 1 | 90 | 6.5 | 67-138 | 30 | 07/10/2022 1632 |
| 6:2 FTS | 15 | 14 | | 1 | 94 | 2.6 | 64-140 | 30 | 07/10/2022 1632 |
| 4:2 FTS | 15 | 17 | | 1 | 116 | 7.6 | 63-143 | 30 | 07/10/2022 1632 |
| EtFOSAA | 16 | 16 | | 1 | 102 | 3.5 | 61-135 | 30 | 07/10/2022 1632 |
| MeFOSA | 16 | 19 | | 1 | 116 | 9.9 | 68-141 | 30 | 07/10/2022 1632 |
| MeFOSAA | 16 | 13 | | 1 | 82 | 18 | 65-136 | 30 | 07/10/2022 1632 |
| PFBS | 14 | 14 | | 1 | 99 | 1.8 | 72-130 | 30 | 07/10/2022 1632 |
| PFDS | 15 | 15 | | 1 | 98 | 7.5 | 53-142 | 30 | 07/10/2022 1632 |
| PFHpS | 15 | 14 | | 1 | 94 | 9.5 | 69-134 | 30 | 07/10/2022 1632 |
| PFNS | 15 | 15 | | 1 | 99 | 6.2 | 69-127 | 30 | 07/10/2022 1632 |
| PFOSA | 16 | 14 | | 1 | 87 | 16 | 67-137 | 30 | 07/10/2022 1632 |
| PFPeS | 15 | 15 | | 1 | 98 | 8.0 | 71-127 | 30 | 07/10/2022 1632 |
| PFHxS | 15 | 14 | | 1 | 96 | 1.3 | 68-131 | 30 | 07/10/2022 1632 |
| PFBA | 16 | 16 | | 1 | 98 | 8.1 | 73-129 | 30 | 07/10/2022 1632 |
| PFDA | 16 | 17 | | 1 | 107 | 4.9 | 71-129 | 30 | 07/10/2022 1632 |
| PFDoA | 16 | 14 | | 1 | 90 | 16 | 72-134 | 30 | 07/10/2022 1632 |
| PFHpA | 16 | 15 | | 1 | 91 | 7.1 | 72-130 | 30 | 07/10/2022 1632 |
| PFHxA | 16 | 17 | | 1 | 107 | 10 | 72-129 | 30 | 07/10/2022 1632 |
| PFNA | 16 | 14 | | 1 | 88 | 7.2 | 69-130 | 30 | 07/10/2022 1632 |
| PFOA | 16 | 15 | | 1 | 96 | 5.6 | 71-133 | 30 | 07/10/2022 1632 |
| PFPeA | 16 | 15 | | 1 | 97 | 4.7 | 72-129 | 30 | 07/10/2022 1632 |
| PFTeDA | 16 | 15 | | 1 | 93 | 6.0 | 71-132 | 30 | 07/10/2022 1632 |
| PFTrDA | 16 | 16 | | 1 | 98 | 4.6 | 65-144 | 30 | 07/10/2022 1632 |
| PFUdA | 16 | 15 | | 1 | 91 | 1.7 | 69-133 | 30 | 07/10/2022 1632 |
| PFOS | 15 | 13 | | 1 | 87 | 7.8 | 65-140 | 30 | 07/10/2022 1632 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 90 | 50-150 |
| 13C2_6:2FTS | N | 194 | 50-150 |
| 13C2_8:2FTS | | 99 | 50-150 |
| 13C2_PFDoA | | 80 | 50-150 |
| 13C2_PFTeDA | | 89 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 |
| 13C4_PFBA | | 94 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 89 | 50-150 |
| 13C7_PFUdA | | 97 | 50-150 |
| 13C8_PFOA | | 92 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCSD

Sample ID: XQ47309-003
Batch: 47309
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/07/2022 1706

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 |
| d-MeFOSA | | 51 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47731-001
Batch: 47731
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/12/2022 1625

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/13/2022 1703 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/13/2022 1703 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/13/2022 1703 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/13/2022 1703 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 07/13/2022 1703 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/13/2022 1703 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/13/2022 1703 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 104 | 50-150 |
| 13C2_6:2FTS | | 115 | 50-150 |
| 13C2_8:2FTS | | 92 | 50-150 |
| 13C2_PFDoA | | 95 | 50-150 |
| 13C2_PFTeDA | | 89 | 50-150 |
| 13C3_PFBS | | 92 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 |
| 13C6_PFDA | | 93 | 50-150 |
| 13C7_PFUdA | | 94 | 50-150 |
| 13C8_PFOA | | 98 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47731-001
Batch: 47731
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/12/2022 1625

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 96 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 |
| 13C9_PFNA | | 96 | 50-150 |
| d5-EtFOSAA | | 98 | 50-150 |
| d-MeFOSA | | 60 | 50-150 |
| d3-MeFOSAA | | 100 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47731-002
Batch: 47731
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/12/2022 1625

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 15 | | 1 | 96 | 67-138 | 07/13/2022 1714 |
| 6:2 FTS | 15 | 14 | | 1 | 95 | 64-140 | 07/13/2022 1714 |
| 4:2 FTS | 15 | 14 | | 1 | 90 | 63-143 | 07/13/2022 1714 |
| EtFOSAA | 16 | 15 | | 1 | 94 | 61-135 | 07/13/2022 1714 |
| MeFOSA | 16 | 16 | | 1 | 99 | 68-141 | 07/13/2022 1714 |
| MeFOSAA | 16 | 17 | | 1 | 105 | 65-136 | 07/13/2022 1714 |
| PFBS | 14 | 14 | | 1 | 99 | 72-130 | 07/13/2022 1714 |
| PFDS | 15 | 15 | | 1 | 100 | 53-142 | 07/13/2022 1714 |
| PFHpS | 15 | 15 | | 1 | 97 | 69-134 | 07/13/2022 1714 |
| PFNS | 15 | 15 | | 1 | 99 | 69-127 | 07/13/2022 1714 |
| PFOSA | 16 | 15 | | 1 | 93 | 67-137 | 07/13/2022 1714 |
| PFPeS | 15 | 14 | | 1 | 91 | 71-127 | 07/13/2022 1714 |
| PFHxS | 15 | 14 | | 1 | 95 | 68-131 | 07/13/2022 1714 |
| PFBA | 16 | 16 | | 1 | 97 | 73-129 | 07/13/2022 1714 |
| PFDA | 16 | 15 | | 1 | 92 | 71-129 | 07/13/2022 1714 |
| PFDoA | 16 | 15 | | 1 | 94 | 72-134 | 07/13/2022 1714 |
| PFHpA | 16 | 15 | | 1 | 94 | 72-130 | 07/13/2022 1714 |
| PFHxA | 16 | 15 | | 1 | 95 | 72-129 | 07/13/2022 1714 |
| PFNA | 16 | 16 | | 1 | 100 | 69-130 | 07/13/2022 1714 |
| PFOA | 16 | 15 | | 1 | 97 | 71-133 | 07/13/2022 1714 |
| PFPeA | 16 | 16 | | 1 | 99 | 72-129 | 07/13/2022 1714 |
| PFTeDA | 16 | 16 | | 1 | 97 | 71-132 | 07/13/2022 1714 |
| PFTrDA | 16 | 15 | | 1 | 96 | 65-144 | 07/13/2022 1714 |
| PFUdA | 16 | 15 | | 1 | 92 | 69-133 | 07/13/2022 1714 |
| PFOS | 15 | 15 | | 1 | 98 | 65-140 | 07/13/2022 1714 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 107 | 50-150 |
| 13C2_6:2FTS | | 123 | 50-150 |
| 13C2_8:2FTS | | 96 | 50-150 |
| 13C2_PFDoA | | 98 | 50-150 |
| 13C2_PFTeDA | | 94 | 50-150 |
| 13C3_PFBS | | 101 | 50-150 |
| 13C3_PFHxS | | 102 | 50-150 |
| 13C4_PFBA | | 100 | 50-150 |
| 13C4_PFHpA | | 102 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 102 | 50-150 |
| 13C7_PFUdA | | 103 | 50-150 |
| 13C8_PFOA | | 107 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47731-002
Batch: 47731
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/12/2022 1625

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 98 | 50-150 |
| 13C8_PFOSA | | 110 | 50-150 |
| 13C9_PFNA | | 101 | 50-150 |
| d5-EtFOSAA | | 106 | 50-150 |
| d-MeFOSA | | 72 | 50-150 |
| d3-MeFOSAA | | 103 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47821-001
Batch: 47821
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/13/2022 1216

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/15/2022 1311 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/15/2022 1311 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/15/2022 1311 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/15/2022 1311 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 07/15/2022 1311 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/15/2022 1311 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/15/2022 1311 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 102 | 50-150 |
| 13C2_6:2FTS | | 119 | 50-150 |
| 13C2_8:2FTS | | 92 | 50-150 |
| 13C2_PFDoA | | 104 | 50-150 |
| 13C2_PFTeDA | | 94 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 |
| 13C4_PFBA | | 102 | 50-150 |
| 13C4_PFHpA | | 101 | 50-150 |
| 13C5_PFHxA | | 102 | 50-150 |
| 13C5_PFPeA | | 99 | 50-150 |
| 13C6_PFDA | | 95 | 50-150 |
| 13C7_PFUdA | | 105 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47821-001
Batch: 47821
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/13/2022 1216

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 99 | 50-150 |
| 13C8_PFOSA | | 102 | 50-150 |
| 13C9_PFNA | | 94 | 50-150 |
| d5-EtFOSAA | | 97 | 50-150 |
| d-MeFOSA | | 75 | 50-150 |
| d3-MeFOSAA | | 98 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47821-002
Batch: 47821
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/13/2022 1216

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 16 | | 1 | 107 | 67-138 | 07/15/2022 1322 |
| 6:2 FTS | 15 | 16 | | 1 | 106 | 64-140 | 07/15/2022 1322 |
| 4:2 FTS | 15 | 15 | | 1 | 98 | 63-143 | 07/15/2022 1322 |
| EtFOSAA | 16 | 16 | | 1 | 103 | 61-135 | 07/15/2022 1322 |
| MeFOSA | 16 | 17 | | 1 | 103 | 68-141 | 07/15/2022 1322 |
| MeFOSAA | 16 | 16 | | 1 | 102 | 65-136 | 07/15/2022 1322 |
| PFBS | 14 | 15 | | 1 | 105 | 72-130 | 07/15/2022 1322 |
| PFDS | 15 | 16 | | 1 | 103 | 53-142 | 07/15/2022 1322 |
| PFHpS | 15 | 17 | | 1 | 110 | 69-134 | 07/15/2022 1322 |
| PFNS | 15 | 14 | | 1 | 94 | 69-127 | 07/15/2022 1322 |
| PFOSA | 16 | 16 | | 1 | 102 | 67-137 | 07/15/2022 1322 |
| PFPeS | 15 | 16 | | 1 | 106 | 71-127 | 07/15/2022 1322 |
| PFHxS | 15 | 15 | | 1 | 105 | 68-131 | 07/15/2022 1322 |
| PFBA | 16 | 17 | | 1 | 103 | 73-129 | 07/15/2022 1322 |
| PFDA | 16 | 17 | | 1 | 106 | 71-129 | 07/15/2022 1322 |
| PFDoA | 16 | 16 | | 1 | 100 | 72-134 | 07/15/2022 1322 |
| PFHpA | 16 | 15 | | 1 | 93 | 72-130 | 07/15/2022 1322 |
| PFHxA | 16 | 16 | | 1 | 103 | 72-129 | 07/15/2022 1322 |
| PFNA | 16 | 16 | | 1 | 99 | 69-130 | 07/15/2022 1322 |
| PFOA | 16 | 17 | | 1 | 106 | 71-133 | 07/15/2022 1322 |
| PFPeA | 16 | 16 | | 1 | 102 | 72-129 | 07/15/2022 1322 |
| PFTeDA | 16 | 16 | | 1 | 100 | 71-132 | 07/15/2022 1322 |
| PFTrDA | 16 | 16 | | 1 | 99 | 65-144 | 07/15/2022 1322 |
| PFUdA | 16 | 15 | | 1 | 97 | 69-133 | 07/15/2022 1322 |
| PFOS | 15 | 14 | | 1 | 97 | 65-140 | 07/15/2022 1322 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 103 | 50-150 |
| 13C2_6:2FTS | | 114 | 50-150 |
| 13C2_8:2FTS | | 94 | 50-150 |
| 13C2_PFDoA | | 101 | 50-150 |
| 13C2_PFTeDA | | 96 | 50-150 |
| 13C3_PFBS | | 96 | 50-150 |
| 13C3_PFHxS | | 98 | 50-150 |
| 13C4_PFBA | | 100 | 50-150 |
| 13C4_PFHpA | | 103 | 50-150 |
| 13C5_PFHxA | | 100 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 94 | 50-150 |
| 13C7_PFUdA | | 106 | 50-150 |
| 13C8_PFOA | | 96 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47821-002
Batch: 47821
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/13/2022 1216

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 100 | 50-150 |
| 13C8_PFOSA | | 99 | 50-150 |
| 13C9_PFNA | | 93 | 50-150 |
| d5-EtFOSAA | | 99 | 50-150 |
| d-MeFOSA | | 75 | 50-150 |
| d3-MeFOSAA | | 100 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCSD

Sample ID: XQ47821-003
Batch: 47821
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/13/2022 1216

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 14 | | 1 | 93 | 14 | 67-138 | 30 | 07/15/2022 1333 |
| 6:2 FTS | 15 | 17 | | 1 | 114 | 7.6 | 64-140 | 30 | 07/15/2022 1333 |
| 4:2 FTS | 15 | 13 | | 1 | 88 | 11 | 63-143 | 30 | 07/15/2022 1333 |
| EtFOSAA | 16 | 15 | | 1 | 92 | 11 | 61-135 | 30 | 07/15/2022 1333 |
| MeFOSA | 16 | 16 | | 1 | 102 | 1.3 | 68-141 | 30 | 07/15/2022 1333 |
| MeFOSAA | 16 | 15 | | 1 | 96 | 6.1 | 65-136 | 30 | 07/15/2022 1333 |
| PFBS | 14 | 15 | | 1 | 103 | 2.2 | 72-130 | 30 | 07/15/2022 1333 |
| PFDS | 15 | 16 | | 1 | 105 | 2.2 | 53-142 | 30 | 07/15/2022 1333 |
| PFHpS | 15 | 15 | | 1 | 99 | 11 | 69-134 | 30 | 07/15/2022 1333 |
| PFNS | 15 | 16 | | 1 | 102 | 8.8 | 69-127 | 30 | 07/15/2022 1333 |
| PFOSA | 16 | 15 | | 1 | 96 | 5.2 | 67-137 | 30 | 07/15/2022 1333 |
| PFPeS | 15 | 16 | | 1 | 104 | 2.2 | 71-127 | 30 | 07/15/2022 1333 |
| PFHxS | 15 | 14 | | 1 | 98 | 6.8 | 68-131 | 30 | 07/15/2022 1333 |
| PFBA | 16 | 16 | | 1 | 102 | 1.7 | 73-129 | 30 | 07/15/2022 1333 |
| PFDA | 16 | 16 | | 1 | 98 | 8.0 | 71-129 | 30 | 07/15/2022 1333 |
| PFDoA | 16 | 16 | | 1 | 98 | 2.7 | 72-134 | 30 | 07/15/2022 1333 |
| PFHpA | 16 | 17 | | 1 | 105 | 12 | 72-130 | 30 | 07/15/2022 1333 |
| PFHxA | 16 | 16 | | 1 | 102 | 0.63 | 72-129 | 30 | 07/15/2022 1333 |
| PFNA | 16 | 15 | | 1 | 91 | 8.2 | 69-130 | 30 | 07/15/2022 1333 |
| PFOA | 16 | 16 | | 1 | 99 | 7.3 | 71-133 | 30 | 07/15/2022 1333 |
| PFPeA | 16 | 16 | | 1 | 101 | 1.4 | 72-129 | 30 | 07/15/2022 1333 |
| PFTeDA | 16 | 16 | | 1 | 100 | 0.047 | 71-132 | 30 | 07/15/2022 1333 |
| PFTrDA | 16 | 15 | | 1 | 96 | 3.1 | 65-144 | 30 | 07/15/2022 1333 |
| PFUdA | 16 | 16 | | 1 | 99 | 2.9 | 69-133 | 30 | 07/15/2022 1333 |
| PFOS | 15 | 15 | | 1 | 100 | 3.0 | 65-140 | 30 | 07/15/2022 1333 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 107 | 50-150 |
| 13C2_6:2FTS | | 140 | 50-150 |
| 13C2_8:2FTS | | 95 | 50-150 |
| 13C2_PFDoA | | 106 | 50-150 |
| 13C2_PFTeDA | | 97 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 102 | 50-150 |
| 13C4_PFBA | | 101 | 50-150 |
| 13C4_PFHpA | | 103 | 50-150 |
| 13C5_PFHxA | | 97 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 |
| 13C7_PFUdA | | 103 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCSD

Sample ID: XQ47821-003
Batch: 47821
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/13/2022 1216

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 101 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d5-EtFOSAA | | 104 | 50-150 |
| d-MeFOSA | | 72 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47961-001
Batch: 47961
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/14/2022 1242

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/18/2022 1208 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/18/2022 1208 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/18/2022 1208 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/18/2022 1208 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 07/18/2022 1208 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/18/2022 1208 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/18/2022 1208 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 119 | 50-150 |
| 13C2_6:2FTS | | 139 | 50-150 |
| 13C2_8:2FTS | | 99 | 50-150 |
| 13C2_PFDoA | | 99 | 50-150 |
| 13C2_PFTeDA | | 94 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 |
| 13C4_PFBA | | 101 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 102 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 |
| 13C6_PFDA | | 101 | 50-150 |
| 13C7_PFUdA | | 96 | 50-150 |
| 13C8_PFOA | | 101 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ47961-001
Batch: 47961
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/14/2022 1242

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 102 | 50-150 |
| 13C8_PFOSA | | 104 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d5-EtFOSAA | | 103 | 50-150 |
| d-MeFOSA | | 81 | 50-150 |
| d3-MeFOSAA | | 103 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47961-002
Batch: 47961
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/14/2022 1242

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 14 | | 1 | 93 | 67-138 | 07/18/2022 1219 |
| 6:2 FTS | 15 | 21 | | 1 | 138 | 64-140 | 07/18/2022 1219 |
| 4:2 FTS | 15 | 13 | | 1 | 86 | 63-143 | 07/18/2022 1219 |
| EtFOSAA | 16 | 16 | | 1 | 98 | 61-135 | 07/18/2022 1219 |
| MeFOSA | 16 | 18 | | 1 | 115 | 68-141 | 07/18/2022 1219 |
| MeFOSAA | 16 | 15 | | 1 | 94 | 65-136 | 07/18/2022 1219 |
| PFBS | 14 | 15 | | 1 | 106 | 72-130 | 07/18/2022 1219 |
| PFDS | 15 | 14 | | 1 | 93 | 53-142 | 07/18/2022 1219 |
| PFHpS | 15 | 15 | | 1 | 100 | 69-134 | 07/18/2022 1219 |
| PFNS | 15 | 14 | | 1 | 94 | 69-127 | 07/18/2022 1219 |
| PFOSA | 16 | 16 | | 1 | 102 | 67-137 | 07/18/2022 1219 |
| PFPeS | 15 | 16 | | 1 | 109 | 71-127 | 07/18/2022 1219 |
| PFHxS | 15 | 14 | | 1 | 94 | 68-131 | 07/18/2022 1219 |
| PFBA | 16 | 17 | | 1 | 104 | 73-129 | 07/18/2022 1219 |
| PFDA | 16 | 16 | | 1 | 101 | 71-129 | 07/18/2022 1219 |
| PFDoA | 16 | 16 | | 1 | 100 | 72-134 | 07/18/2022 1219 |
| PFHpA | 16 | 16 | | 1 | 99 | 72-130 | 07/18/2022 1219 |
| PFHxA | 16 | 16 | | 1 | 102 | 72-129 | 07/18/2022 1219 |
| PFNA | 16 | 16 | | 1 | 101 | 69-130 | 07/18/2022 1219 |
| PFOA | 16 | 15 | | 1 | 96 | 71-133 | 07/18/2022 1219 |
| PFPeA | 16 | 16 | | 1 | 100 | 72-129 | 07/18/2022 1219 |
| PFTeDA | 16 | 17 | | 1 | 105 | 71-132 | 07/18/2022 1219 |
| PFTrDA | 16 | 15 | | 1 | 97 | 65-144 | 07/18/2022 1219 |
| PFUdA | 16 | 16 | | 1 | 99 | 69-133 | 07/18/2022 1219 |
| PFOS | 15 | 15 | | 1 | 98 | 65-140 | 07/18/2022 1219 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 119 | 50-150 |
| 13C2_6:2FTS | | 138 | 50-150 |
| 13C2_8:2FTS | | 100 | 50-150 |
| 13C2_PFDoA | | 98 | 50-150 |
| 13C2_PFTeDA | | 92 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 |
| 13C3_PFHxS | | 98 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 |
| 13C4_PFHpA | | 96 | 50-150 |
| 13C5_PFHxA | | 97 | 50-150 |
| 13C5_PFPeA | | 99 | 50-150 |
| 13C6_PFDA | | 101 | 50-150 |
| 13C7_PFUdA | | 94 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ47961-002
Batch: 47961
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/14/2022 1242

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 103 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |
| d5-EtFOSAA | | 100 | 50-150 |
| d-MeFOSA | | 68 | 50-150 |
| d3-MeFOSAA | | 105 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ48567-001
Batch: 48567
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/20/2022 1618

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/25/2022 2057 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/25/2022 2057 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/25/2022 2057 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/25/2022 2057 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 07/25/2022 2057 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 07/25/2022 2057 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 07/25/2022 2057 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 |
| 13C2_6:2FTS | | 143 | 50-150 |
| 13C2_8:2FTS | | 81 | 50-150 |
| 13C2_PFDoA | | 98 | 50-150 |
| 13C2_PFTeDA | | 92 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 |
| 13C3_PFHxS | | 88 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 101 | 50-150 |
| 13C5_PFHxA | | 96 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 |
| 13C6_PFDA | | 107 | 50-150 |
| 13C7_PFUdA | | 109 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ48567-001
Batch: 48567
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/20/2022 1618

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 98 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 101 | 50-150 |
| d5-EtFOSAA | | 106 | 50-150 |
| d-MeFOSA | | 74 | 50-150 |
| d3-MeFOSAA | | 107 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ48567-002
Batch: 48567
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/20/2022 1618

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 15 | | 1 | 98 | 67-138 | 07/25/2022 2107 |
| 6:2 FTS | 15 | 16 | | 1 | 105 | 64-140 | 07/25/2022 2107 |
| 4:2 FTS | 15 | 11 | | 1 | 76 | 63-143 | 07/25/2022 2107 |
| EtFOSAA | 16 | 14 | | 1 | 86 | 61-135 | 07/25/2022 2107 |
| MeFOSA | 16 | 16 | | 1 | 100 | 68-141 | 07/25/2022 2107 |
| MeFOSAA | 16 | 14 | | 1 | 87 | 65-136 | 07/25/2022 2107 |
| PFBS | 14 | 13 | | 1 | 90 | 72-130 | 07/25/2022 2107 |
| PFDS | 15 | 13 | | 1 | 87 | 53-142 | 07/25/2022 2107 |
| PFHpS | 15 | 14 | | 1 | 91 | 69-134 | 07/25/2022 2107 |
| PFNS | 15 | 14 | | 1 | 93 | 69-127 | 07/25/2022 2107 |
| PFOSA | 16 | 14 | | 1 | 90 | 67-137 | 07/25/2022 2107 |
| PFPeS | 15 | 13 | | 1 | 84 | 71-127 | 07/25/2022 2107 |
| PFHxS | 15 | 13 | | 1 | 92 | 68-131 | 07/25/2022 2107 |
| PFBA | 16 | 16 | | 1 | 99 | 73-129 | 07/25/2022 2107 |
| PFDA | 16 | 15 | | 1 | 92 | 71-129 | 07/25/2022 2107 |
| PFDoA | 16 | 15 | | 1 | 94 | 72-134 | 07/25/2022 2107 |
| PFHpA | 16 | 15 | | 1 | 95 | 72-130 | 07/25/2022 2107 |
| PFHxA | 16 | 17 | | 1 | 108 | 72-129 | 07/25/2022 2107 |
| PFNA | 16 | 15 | | 1 | 93 | 69-130 | 07/25/2022 2107 |
| PFOA | 16 | 14 | | 1 | 85 | 71-133 | 07/25/2022 2107 |
| PFPeA | 16 | 14 | | 1 | 89 | 72-129 | 07/25/2022 2107 |
| PFTeDA | 16 | 15 | | 1 | 92 | 71-132 | 07/25/2022 2107 |
| PFTrDA | 16 | 14 | | 1 | 90 | 65-144 | 07/25/2022 2107 |
| PFUdA | 16 | 14 | | 1 | 88 | 69-133 | 07/25/2022 2107 |
| PFOS | 15 | 13 | | 1 | 87 | 65-140 | 07/25/2022 2107 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 115 | 50-150 |
| 13C2_6:2FTS | | 132 | 50-150 |
| 13C2_8:2FTS | | 95 | 50-150 |
| 13C2_PFDoA | | 104 | 50-150 |
| 13C2_PFTeDA | | 111 | 50-150 |
| 13C3_PFBS | | 107 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 |
| 13C4_PFBA | | 100 | 50-150 |
| 13C4_PFHpA | | 101 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 |
| 13C5_PFPeA | | 105 | 50-150 |
| 13C6_PFDA | | 101 | 50-150 |
| 13C7_PFUdA | | 105 | 50-150 |
| 13C8_PFOA | | 110 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ48567-002
Batch: 48567
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 07/20/2022 1618

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 100 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 104 | 50-150 |
| d5-EtFOSAA | | 116 | 50-150 |
| d-MeFOSA | | 78 | 50-150 |
| d3-MeFOSAA | | 109 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# Chain of Custody
# and
# Miscellaneous Documents

Pace Analytical

Cooler 2 of 2

**PACE ANALYTICAL SERVICES, LLC**
108 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 135005

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: 231-534-5092/khasbrouck@arcadis.com, 720-208-5367/Craig.Divine@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: Austin Westhuis | Analysis (Attach list if more space is needed) | Page 1 of 2 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | |
| Project Name: ESTCP Vertebrae - Grayling, MI | | | XF17016 |
| Project No.: 30027244.00003 | P.O. No. | | KEB |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab / Composite | Matrix: Aqueous | Soil | Non-Aqueous | No of Containers by Preservative Type: Unpres. | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | Other | PFAS per USEPA Method 537 Isotope Dilution (Table 3, 5, 6, 7, 8, 9 & 10) | Total Organic Carbon | Top Assay | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-VRTB-3_06142022 | 6/14/22 | 1910 | G | X | | | 2 | | | | | | | X | | | |
| VRTB-D-B1_06152022 | 6/15/22 | 1025 | G | X | | | 2 | | | | | | | X | | | |
| VRTB-D-S2_06152022 | 6/15/22 | 1105 | G | X | | | 2 | | | | | | | X | | | |
| VRTB-D-Y3_06152022 | 6/15/22 | 1150 | G | X | | | 2 | | | | | | | X | | | |
| VRTB-D-G4_06152022 | 6/15/22 | 1305 | G | X | | | 2 | | | | | | | X | | | |
| MW-VRTB-1D_06152022 | 6/15/22 | 1350 | G | X | | | 2 | | | | | | | X | | | |
| MW-VRTB-1S_06152022 | 6/15/22 | 1425 | G | X | | | 2 | | | | | | | X | | | |
| CMT-VRTB-01_1_06152022 | 6/15/22 | 1525 | G | X | | | 2 | | | | | | | X | | X | Top Assay Analysis Only |
| CMT-VRTB-01_2_06152022 | 6/15/22 | 1610 | G | X | | | 2 | | | | | | | X | | | |
| CMT-VRTB-01_3_06152022 | 6/15/22 | 1650 | G | X | | | 2 | | | | | | | X | | | |

Turn Around Time Required (Prior lab approval required for expedited TAT): [X] Standard [ ] Rush (Specify)

Sample Disposal: [ ] Return to Client [X] Disposal by Lab

Possible Hazard Identification: [X] Non-Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison [ ] Unknown

QC Requirements (Specify)

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | 6/16/22 | | 1. Received by: FedEx | 6/16/22 | |
| 2. Relinquished by | Date | Time | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: FedEx | 6-17-22 | 0815 | 4. Laboratory received by | 6-17-22 | 0815 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle): (Yes) No — Ice Pack — Receipt Temp: 5.8 °C — Temp Blank: [ ] Y [ ] N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

* Level II Package Required

Document Number: MF003N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

Cooler 2 of 2

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 135007

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: (321-534-5092 / khasbrouck@tamp.com), (720-308-5361 / Craig.Divine@arcadis.com) | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x [signature] | Analysis (Attach list if more space is needed) | Page 2 of 2 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | XF17016 |
| Project Name: ESTCP Vertebrae - Grayling, MI | | | KES? |
| Project No.: 3002 7244.00003 | P.O. No. | | Remarks / Cooler I.D. |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | GeoGrab Calculated | Matrix: Aqueous | Soil | Non-Aqueous | No. of Containers by Preservative Type: Unpres. | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | Field Filtered | PFAS 25 (USEPA Method 537 Isotope dilution Rev. 1.1) | Total Organic Carbon | TOP Assay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMT-VRTB-01_4_06152022 | 6/15/22 | ~~1625~~ 1795 | G | X | | | 2 | | | | | | | X | | |
| CMT-VRTB-01_5_06152022 | 6/15/22 | 1810 | G | X | | | 2 | | | | | | | X | | |
| CMT-VRTB-01_6_06152022 | 6/15/22 | 1845 | G | X | | | 2 | | | | | | | X | | |
| CMT-VRTB-01_7_06152022 | 6/15/22 | 1910 | G | X | | | 2 | | | | | | | X | | |
| VRTB-S-M5_06162022 | 6/16/22 | 0905 | G | X | | | 2 | 1 | | | | | | X | X | |
| VRTB-S-06_06162022 | 6/16/22 | 1025 | G | X | | | 2 | | | | | | | X | | |
| VRTB-S-R7_06162022 | 6/16/22 | 1120 | G | X | | | 2 | 1 | | | | | | X | X | |
| VRTB-S-P8_06162022 | 6/16/22 | 1215 | G | X | | | 2 | | | | | | | X | | |

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client ☒ Disposal by Lab

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | 6/16/22 | | 1. Received by: FedEx | 6/16/22 | |
| 2. Relinquished by | | | 2. Received by | | |
| 3. Relinquished by | | | 3. Received by | | |
| 4. Relinquished by: FedEx | 6-17-22 | 0955 | 4. Laboratory received by: [signature] | 6-17-22 | 0955 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle): (Yes) No Ice Pack — Receipt Temp: 5.8 °C — Temp Blank: ☒ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy — * Level II Package Required

Document Number: ME503NB-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

# Sample Receipt Checklist (SRC)

Client: Arcadis  Cooler Inspected by/date: TEC / 06/17/2022  Lot #: XF17016

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No | ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: 21-852  Chlorine Strip ID: NA  Tested by: TEC

Original temperature upon receipt / Derived (Corrected) temperature upon receipt: %Solid Snap-Cup ID: NA

5.8 / 5.8 °C  NA / NA °C  NA / NA °C  NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles  IR Gun ID: 6  IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☐ Yes | ☐ No | ☑ NA | 3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☐ Yes | ☐ No | ☑ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC? |
| ☑ Yes | ☐ No | | 7. Were sample IDs listed on all sample containers? |
| ☑ Yes | ☐ No | | 8. Was collection date & time listed on the COC? |
| ☑ Yes | ☐ No | | 9. Was collection date & time listed on all sample containers? |
| ☑ Yes | ☐ No | | 10. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 11. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 13. Was adequate sample volume available? |
| ☐ Yes | ☑ No | | 14. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☐ Yes | ☑ No | | 15. Were any samples containers missing/excess (circle one) samples Not listed on COC? |
| ☐ Yes | ☐ No | ☑ NA | 16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☑ Yes | ☐ No | ☐ NA | 17. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 19. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☐ No | ☑ NA | 20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS? |
| ☑ Yes | ☐ No | | 21. Was the quote number listed on the container label? If yes, Quote # 25221 |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: TEC  Date: 06/17/2022

Comments:

*LELAP CERTIFICATE NUMBER: 01955*
*DOD-ELAP ACCREDITATION NUMBER: 74960*

# ANALYTICAL RESULTS

**PERFORMED BY**

**Pace Analytical Gulf Coast**
**7979 Innovation Park Dr.**
**Baton Rouge, LA 70820**
**(225) 769-4900**

**Report Date** 07/12/2022

**Report #** 222061820

***Project*** XF17016 ESTCP Vertebrae

**Samples Collected** 6/14/22

| ***Deliver To*** | ***Additional Recipients*** |
|---|---|
| Kathy Smith<br>Pace Analytical<br>106 Vantage Point Drive<br>Columbia, SC 29223<br>803-227-2704 | NONE |

# Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with Pace Gulf Coast's Standard Operating Procedures.

**Common Abbreviations that may be Utilized in this Report**

| | |
|---|---|
| **ND** | Indicates the result was Not Detected at the specified reporting limit |
| **NO** | Indicates the sample did not ignite when preliminary test performed for EPA Method 1030 |
| **DO** | Indicates the result was Diluted Out |
| **MI** | Indicates the result was subject to Matrix Interference |
| **TNTC** | Indicates the result was Too Numerous To Count |
| **SUBC** | Indicates the analysis was Sub-Contracted |
| **FLD** | Indicates the analysis was performed in the Field |
| **DL** | Detection Limit |
| **LOD** | Limit of Detection |
| **LOQ** | Limit of Quantitation |
| **RE** | Re-analysis |
| **CF** | HPLC or GC Confirmation |
| **00:01** | Reported as a time equivalent to 12:00 AM |

**Reporting Flags that may be Utilized in this Report**

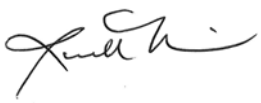
| | |
|---|---|
| **J or I** | Indicates the result is between the MDL and LOQ |
| **J** | DOD flag on analyte in the parent sample for MS/MSD outside acceptance criteria |
| **U** | Indicates the compound was analyzed for but not detected |
| **B or V** | Indicates the analyte was detected in the associated Method Blank |
| **Q** | Indicates a non-compliant QC Result (See Q Flag Application Report) |
| ***** | Indicates a non-compliant or not applicable QC recovery or RPD – see narrative |
| **E** | Organics **-** The result is estimated because it exceeded the instrument calibration range |
| **E** | Metals - % diference for the serial dilution is > 10% |
| **L** | Reporting Limits adjusted to meet risk-based limit. |
| **P** | RPD between primary and confirmation result is greater than 40 |
| **DL** | Diluted analysis – when appended to Client Sample ID |

Sample receipt at Pace Gulf Coast is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of Pace Gulf Coast. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with The NELAC Institute (TNI) Standard 2009 and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.



Authorized Signature
Pace Gulf Coast Report 222061820

# Certifications

| Certification | Certification Number |
|---|---|
| DOD ELAP | 74960 |
| Alabama | 01955 |
| Arkansas | 88-0655 |
| Colorado | 01955 |
| Delaware | 01955 |
| Florida | E87854 |
| Georgia | 01955 |
| Hawaii | 01955 |
| Idaho | 01955 |
| Illinois | 200048 |
| Indiana | 01955 |
| Kansas | E-10354 |
| Kentucky | 95 |
| Louisiana | 01955 |
| Maryland | 01955 |
| Massachusetts | 01955 |
| Michigan | 01955 |
| Mississippi | 01955 |
| Missouri | 01955 |
| Montana | N/A |
| Nebraska | 01955 |
| New Mexico | 01955 |
| North Carolina | 618 |
| North Dakota | R-195 |
| Oklahoma | 9403 |
| South Carolina | 73006001 |
| South Dakota | 01955 |
| Tennessee | 01955 |
| Texas | T104704178 |
| Vermont | 01955 |
| Virginia | 460215 |
| Washington | C929 |
| USDA Soil Permit | P330-16-00234 |

# Case Narrative

**Client:** Pace Analytical Services **Report:** 222061820

Pace Analytical Gulf Coast received and analyzed the sample(s) listed
on the Report Sample Summary page of this report. Receipt of the sample(s) is documented
by the attached chain of custody. This applies only to the sample(s) listed in this report.
No sample integrity or quality control exceptions were identified unless noted below.

**SEMI-VOLATILES MASS SPECTROMETRY**

In the PFAS Top Assay QSM B15 (Pre) analysis, the recovery for the extracted internal standard d7-NMeFOSE is outside the control limits for sample 22206182001 (CMT-VRTB-01_1_0615202) .

In the PFAS Top Assay QSM B15 (Pre) analysis, the recovery for the extracted internal standard d7-NMeFOSE is outside the control limits for sample 2365076 (LCS for HBN 744362 [LCMS/6041]) . The recovery of the associated compounds is within control limits.

# Sample Summary

| Lab ID | Client ID | Matrix | Collect Date | Receive Date |
|---|---|---|---|---|
| 22206182001 | CMT-VRTB-01_1_0615202 | Water | 6/14/22 15:25 | 6/18/22 12:16 |
| 22206182002 | VRTB-S-M5_06162022 | Water | 6/14/22 09:05 | 6/18/22 12:16 |
| 22206182003 | VRTB-S-R7_06162022 | Water | 6/14/22 11:20 | 6/18/22 12:16 |

# Detect Summary

Results and Detection Limits are adjusted for dilution and moisture when applicable

**SM 5310 B-2014**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22206182002 | VRTB-S-M5_06162022 | Total Organic Carbon | mg/L | 23.1 | 1 | NA |
| 22206182003 | VRTB-S-R7_06162022 | Total Organic Carbon | mg/L | 31.2 | 1 | NA |

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 5.62J | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorobutanoic acid (PFBA) | ng/L | 15.8 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 5.58J | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluoroheptanoic acid (PFHpA) | ng/L | 75.4 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 52.3 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorohexanoic acid (PFHxA) | ng/L | 74.8 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 171 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorooctanoic acid (PFOA) | ng/L | 50.8 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluoropentanoic acid (PFPeA) | ng/L | 48.7 | 1 | NA |

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 6.56J | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorobutanoic acid (PFBA) | ng/L | 13.1 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 5.97J | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluoroheptanoic acid (PFHpA) | ng/L | 81.5 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 58.1 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorohexanoic acid (PFHxA) | ng/L | 32.7 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 243 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluorooctanoic acid (PFOA) | ng/L | 55.7 | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 2.72J | 1 | NA |
| 22206182001 | CMT-VRTB-01_1_0615202 | Perfluoropentanoic acid (PFPeA) | ng/L | 40.5 | 1 | NA |

# Sample Results

| CMT-VRTB-01_1_0615202 | Collect Date | 06/14/2022 15:25 | Lab ID | 22206182001 |
|---|---|---|---|---|
| | Receive Date | 06/18/2022 12:16 | Matrix | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 06/29/22 15:38 | 744362 | PFAS Top Assay QSM B15 (Pre) | 1 | 07/02/22 02:00 | 744596 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 4.25U | 4.25 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 3.50U | 3.50 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 2.53U | 2.53 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 4.15U | 4.15 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 3.25U | 3.25 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 3.75U | 3.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 3.88U | 3.88 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 3.48U | 3.48 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 3.75U | 3.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **6.56J** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **13.1** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **5.97J** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **81.5** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **58.1** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **32.7** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 2.45U | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **243** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **55.7** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **2.72J** | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **40.5** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 3.28U | 3.28 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 3.75U | 3.75 | 10.0 | ng/L |

# Sample Results

| **CMT-VRTB-01_1_0615202** | **Collect Date** | 06/14/2022 15:25 | **Lab ID** | 22206182001 |
|---|---|---|---|---|
| | **Receive Date** | 06/18/2022 12:16 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 06/29/22 15:38 | 744362 | PFAS Top Assay QSM B15 (Pre) | 1 | 07/02/22 02:00 | 744596 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 2.58U | 2.58 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 570 | ng/L | 114 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 164 | ng/L | 66 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 155 | ng/L | 62 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 227 | ng/L | 91 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 111 | ng/L | 44* | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 145 | ng/L | 58 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 238 | ng/L | 95 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 273 | ng/L | 109 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 221 | ng/L | 88 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 235 | ng/L | 94 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 241 | ng/L | 96 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 238 | ng/L | 95 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 237 | ng/L | 95 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 244 | ng/L | 98 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 236 | ng/L | 94 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 235 | ng/L | 94 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 244 | ng/L | 98 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 223 | ng/L | 89 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 246 | ng/L | 98 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 226 | ng/L | 90 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 236 | ng/L | 95 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 236 | ng/L | 95 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 242 | ng/L | 97 | 50 - 150 |

# Sample Results

| CMT-VRTB-01_1_0615202 | Collect Date | 06/14/2022 15:25 | Lab ID | 22206182001 |
|---|---|---|---|---|
| | Receive Date | 06/18/2022 12:16 | Matrix | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 07/05/22 12:30 | 744694 | PFAS Top Assay QSM B15 (Post) | 1 | 07/07/22 00:36 | 744833 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 4.25U | 4.25 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 2.25U | 2.25 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 2.25U | 2.25 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 2.15U | 2.15 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 3.50U | 3.50 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 3.95U | 3.95 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 2.53U | 2.53 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 4.15U | 4.15 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 2.25U | 2.25 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 3.25U | 3.25 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 3.75U | 3.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 3.88U | 3.88 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7 | 50.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 3.48U | 3.48 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 3.75U | 3.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **5.62J** | 1.55 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **15.8** | 3.80 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 3.60U | 3.60 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **5.58J** | 3.05 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **75.4** | 2.90 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **52.3** | 3.10 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **74.8** | 2.35 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35 | 10.0 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 2.45U | 2.45 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **171** | 1.90 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **50.8** | 2.10 | 10.0 | ng/L |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 2.55U | 2.55 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **48.7** | 2.20 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 3.28U | 3.28 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 3.75U | 3.75 | 10.0 | ng/L |

# Sample Results

| **CMT-VRTB-01_1_0615202** | **Collect Date** | 06/14/2022 15:25 | **Lab ID** | 22206182001 |
|---|---|---|---|---|
| | **Receive Date** | 06/18/2022 12:16 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 07/05/22 12:30 | 744694 | PFAS Top Assay QSM B15 (Post) | 1 | 07/07/22 00:36 | 744833 | SXA | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 2.58U | 2.58 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 571 | ng/L | 114 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 158 | ng/L | 63 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 156 | ng/L | 63 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 229 | ng/L | 92 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 244 | ng/L | 98 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 172 | ng/L | 69 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 176 | ng/L | 70 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 261 | ng/L | 105 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 241 | ng/L | 96 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 259 | ng/L | 104 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 207 | ng/L | 83 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 215 | ng/L | 86 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 261 | ng/L | 105 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 244 | ng/L | 98 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 241 | ng/L | 96 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 246 | ng/L | 98 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 243 | ng/L | 97 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 238 | ng/L | 95 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 247 | ng/L | 99 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 244 | ng/L | 97 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 210 | ng/L | 84 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 243 | ng/L | 97 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 243 | ng/L | 97 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 234 | ng/L | 94 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 231 | ng/L | 92 | 50 - 150 |

| **VRTB-S-M5_06162022** | **Collect Date** | 06/14/2022 09:05 | **Lab ID** | 22206182002 |
|---|---|---|---|---|
| | **Receive Date** | 06/18/2022 12:16 | **Matrix** | Water |

## SM 5310 B-2014

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| NA | NA | NA | 1 | 06/21/22 21:02 | 743676 | JGD | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| C-012 | **Total Organic Carbon** | **23.1** | 0.300 | 2.00 | mg/L |

# Sample Results

| **VRTB-S-R7_06162022** | **Collect Date** | 06/14/2022 11:20 | **Lab ID** | 22206182003 |
|---|---|---|---|---|
| | **Receive Date** | 06/18/2022 12:16 | **Matrix** | Water |

## SM 5310 B-2014

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| NA | NA | NA | 1 | 06/21/22 21:21 | 743676 | JGD | NA |

| CAS# | Parameter | Result | DL | LOQ | Units |
|---|---|---|---|---|---|
| C-012 | **Total Organic Carbon** | **31.2** | 0.300 | 2.00 | mg/L |

# LC-MS/MS QC Summary

| | | | |
|---|---|---|---|
| **Analytical Batch** | Client ID | MB744694 | |
| 744833 | Lab ID | 2367051 | |
| **Prep Batch** | Sample Type | MB | |
| 744694 | Prep Date | 07/05/22 12:30 | |
| **Prep Method** | Analysis Date | 07/06/22 23:51 | |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | |
| **PFAS Top Assay QSM B15 (Post)** | | Units<br>Result | ng/L<br>DL |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 120226-60-0 | 4.25U | 4.25 |
| 11Cl-PF3OUdS | 763051-92-9 | 2.25U | 2.25 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 3.10U | 3.10 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 3.75U | 3.75 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 2.65U | 2.65 |
| 9Cl-PF3ONS | 756426-58-1 | 2.25U | 2.25 |
| ADONA | 919005-14-4 | 2.15U | 2.15 |
| NEtFOSA | 4151-50-2 | 3.50U | 3.50 |
| NEtFOSAA | 2991-50-6 | 3.95U | 3.95 |
| NEtFOSE | 1691-99-2 | 2.53U | 2.53 |
| NMeFOSA | 31506-32-8 | 4.15U | 4.15 |
| NMeFOSAA | 2355-31-9 | 2.25U | 2.25 |
| NMeFOSE | 24448-09-7 | 3.25U | 3.25 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 3.75U | 3.75 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 3.88U | 3.88 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 16.7U | 16.7 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 3.48U | 3.48 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 3.75U | 3.75 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1.55U | 1.55 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 3.80U | 3.80 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 3.05U | 3.05 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 3.60U | 3.60 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 3.25U | 3.25 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 3.05U | 3.05 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 2.90U | 2.90 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 3.10U | 3.10 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 2.35U | 2.35 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 4.35U | 4.35 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 2.45U | 2.45 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 1.85U | 1.85 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1.90U | 1.90 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 2.10U | 2.10 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 2.55U | 2.55 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 2.20U | 2.20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 2.85U | 2.85 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 3.08U | 3.08 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 3.10U | 3.10 |
| PFDoS | 79780-39-5 | 3.28U | 3.28 |
| PFHxDA | 67905-19-5 | 3.75U | 3.75 |
| PFODA | 16517-11-6 | 2.58U | 2.58 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** |
| d3-NMeFOSAA | 2355-31-9-EIS | 233 | 93 |
| d5-NEtFOSAA | 2991-50-6-EIS | 245 | 98 |
| d7-NMeFOSE | 24448-09-7-EIS | 171 | 69 |
| d9-NEtFOSE | 1691-99-2-EIS | 162 | 65 |
| d-NEtFOSA | 4151-50-2-EIS | 121 | **48*** |
| d-NMeFOSA | 31506-32-8-EIS | 124 | 50 |
| M2 4:2 FTS | 757124-72-4-EIS | 270 | 108 |
| M2 6:2 FTS | 27619-97-2-EIS | 235 | 94 |
| M2 8:2 FTS | 39108-34-4-EIS | 257 | 103 |
| M2PFHxDA | 67905-19-5-EIS | 263 | 105 |
| M2PFTA | 376-06-7-EIS | 223 | 89 |
| M3HFPODA | 13252-13-6-EIS | 275 | 110 |
| M3PFBS | 375-73-5-EIS | 233 | 93 |
| M3PFHxS | 355-46-4-EIS | 233 | 93 |
| M4PFHpA | 375-85-9-EIS | 238 | 95 |
| M5PFHxA | 307-24-4-EIS | 238 | 95 |
| M5PFPeA | 2706-90-3-EIS | 234 | 93 |

# LC-MS/MS QC Summary

| | | | |
|---|---|---|---|
| **Analytical Batch** | Client ID | MB744694 | |
| 744833 | Lab ID | 2367051 | |
| **Prep Batch** | Sample Type | MB | |
| 744694 | Prep Date | 07/05/22 12:30 | |
| **Prep Method** | Analysis Date | 07/06/22 23:51 | |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | |
| **PFAS Top Assay QSM B15 (Post)** | | Units<br>Result | ng/L<br>DL |
| M6PFDA | 335-76-2-EIS | 242 | 97 |
| M7PFUnA | 2058-94-8-EIS | 242 | 97 |
| M8FOSA | 754-91-6-EIS | 219 | 88 |
| M8PFOA | 335-67-1-EIS | 242 | 97 |
| M8PFOS | 1763-23-1-EIS | 235 | 94 |
| M9PFNA | 375-95-1-EIS | 242 | 97 |
| MPFBA | 375-22-4-EIS | 231 | 92 |
| MPFDoA | 307-55-1-EIS | 232 | 93 |
| MPFOA | 335-67-1-SUR | 486 | 97 |

# LC-MS/MS QC Summary

| | | | |
|---|---|---|---|
| **Analytical Batch** | Client ID | LCSD744694 | |
| 744833 | Lab ID | 2367053 | |
| **Prep Batch** | Sample Type | LCSD | |
| 744694 | Prep Date | 07/05/22 12:30 | |
| **Prep Method** | Analysis Date | 07/07/22 00:21 | |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | |
| **PFAS Top Assay QSM B15 (Post)** | | Units<br>Result | ng/L<br>DL |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 120226-60-0 | 232 | 4.25 |
| 11Cl-PF3OUdS | 763051-92-9 | 209 | 2.25 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 231 | 3.10 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 235 | 3.75 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 245 | 2.65 |
| 9Cl-PF3ONS | 756426-58-1 | 210 | 2.25 |
| ADONA | 919005-14-4 | 218 | 2.15 |
| NEtFOSA | 4151-50-2 | 232 | 3.50 |
| NEtFOSAA | 2991-50-6 | 244 | 3.95 |
| NEtFOSE | 1691-99-2 | 242 | 2.53 |
| NMeFOSA | 31506-32-8 | 238 | 4.15 |
| NMeFOSAA | 2355-31-9 | 240 | 2.25 |
| NMeFOSE | 24448-09-7 | 227 | 3.25 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 239 | 3.75 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 215 | 3.88 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 472 | 16.7 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 236 | 3.48 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 236 | 3.75 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 211 | 1.55 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 239 | 3.80 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 222 | 3.05 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 240 | 3.60 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 239 | 3.25 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 228 | 3.05 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 235 | 2.90 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 220 | 3.10 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 237 | 2.35 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 228 | 4.35 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 238 | 2.45 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 234 | 1.85 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 211 | 1.90 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 235 | 2.10 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 226 | 2.55 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 239 | 2.20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 238 | 2.85 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 238 | 3.08 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 237 | 3.10 |
| PFDoS | 79780-39-5 | 218 | 3.28 |
| PFHxDA | 67905-19-5 | 235 | 3.75 |
| PFODA | 16517-11-6 | 193 | 2.58 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** |
| d3-NMeFOSAA | 2355-31-9-EIS | 236 | 94 |
| d5-NEtFOSAA | 2991-50-6-EIS | 239 | 96 |
| d7-NMeFOSE | 24448-09-7-EIS | 188 | 75 |
| d9-NEtFOSE | 1691-99-2-EIS | 180 | 72 |
| d-NEtFOSA | 4151-50-2-EIS | 138 | 55 |
| d-NMeFOSA | 31506-32-8-EIS | 138 | 55 |
| M2 4:2 FTS | 757124-72-4-EIS | 250 | 100 |
| M2 6:2 FTS | 27619-97-2-EIS | 234 | 94 |
| M2 8:2 FTS | 39108-34-4-EIS | 235 | 94 |
| M2PFHxDA | 67905-19-5-EIS | 271 | 108 |
| M2PFTA | 376-06-7-EIS | 222 | 89 |
| M3HFPODA | 13252-13-6-EIS | 274 | 110 |
| M3PFBS | 375-73-5-EIS | 233 | 93 |
| M3PFHxS | 355-46-4-EIS | 235 | 94 |
| M4PFHpA | 375-85-9-EIS | 241 | 97 |
| M5PFHxA | 307-24-4-EIS | 240 | 96 |
| M5PFPeA | 2706-90-3-EIS | 237 | 95 |

# LC-MS/MS QC Summary

| | | | |
|---|---|---|---|
| **Analytical Batch** | Client ID | LCSD744694 | |
| 744833 | Lab ID | 2367053 | |
| **Prep Batch** | Sample Type | LCSD | |
| 744694 | Prep Date | 07/05/22 12:30 | |
| **Prep Method** | Analysis Date | 07/07/22 00:21 | |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | |
| **PFAS Top Assay QSM B15 (Post)** | | Units<br>Result | ng/L<br>DL |
| M6PFDA | 335-76-2-EIS | 246 | 98 |
| M7PFUnA | 2058-94-8-EIS | 240 | 96 |
| M8FOSA | 754-91-6-EIS | 222 | 89 |
| M8PFOA | 335-67-1-EIS | 244 | 98 |
| M8PFOS | 1763-23-1-EIS | 245 | 98 |
| M9PFNA | 375-95-1-EIS | 245 | 98 |
| MPFBA | 375-22-4-EIS | 233 | 93 |
| MPFDoA | 307-55-1-EIS | 232 | 93 |
| MPFOA | 335-67-1-SUR | 464 | 93 |

# LC-MS/MS QC Summary

| | | | |
|---|---|---|---|
| **Analytical Batch** | Client ID | LCS744694 | |
| 744833 | Lab ID | 2367072 | |
| **Prep Batch** | Sample Type | LCS | |
| 744694 | Prep Date | 07/05/22 12:30 | |
| **Prep Method** | Analysis Date | 07/07/22 02:20 | |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | |

| **PFAS Top Assay QSM B15 (Post)** | | Spike Added | Result | %R | Control Limits%R |
|---|---|---|---|---|---|
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 120226-60-0 | 19.3 | 21.9 | 113 | 70 - 130 |
| 11Cl-PF3OUdS | 763051-92-9 | 18.9 | 21.2 | 113 | 70 - 130 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 18.7 | 22.2 | 119 | 70 - 130 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 19.0 | 22.2 | 117 | 70 - 130 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 19.2 | 23.1 | 120 | 70 - 130 |
| 9Cl-PF3ONS | 756426-58-1 | 18.7 | 21.1 | 113 | 70 - 130 |
| ADONA | 919005-14-4 | 18.9 | 21.5 | 114 | 70 - 130 |
| NEtFOSA | 4151-50-2 | 20.0 | 25.5 | 128 | 70 - 130 |
| NEtFOSAA | 2991-50-6 | 20.0 | 20.9 | 104 | 70 - 130 |
| NEtFOSE | 1691-99-2 | 20.0 | 25.0 | 125 | 70 - 130 |
| NMeFOSA | 31506-32-8 | 20.0 | 24.5 | 122 | 70 - 130 |
| NMeFOSAA | 2355-31-9 | 20.0 | 25.7 | 129 | 70 - 130 |
| NMeFOSE | 24448-09-7 | 20.0 | 23.0 | 115 | 70 - 130 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 20.0 | 23.1 | 116 | 70 - 130 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 17.8 | 21.1 | 119 | 70 - 130 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 40.0 | 47.2 | 118 | 70 - 130 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 20.0 | 23.1 | 115 | 70 - 130 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 20.0 | 22.8 | 114 | 70 - 130 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 17.7 | 20.9 | 118 | 70 - 130 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 20.0 | 23.2 | 116 | 70 - 130 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 19.3 | 22.6 | 117 | 70 - 130 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 20.0 | 23.1 | 116 | 70 - 130 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 20.0 | 22.9 | 115 | 70 - 130 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 19.1 | 22.1 | 116 | 70 - 130 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 20.0 | 23.0 | 115 | 70 - 130 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 18.3 | 21.3 | 116 | 70 - 130 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 20.0 | 22.9 | 115 | 70 - 130 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 19.2 | 22.8 | 118 | 70 - 130 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 20.0 | 23.3 | 117 | 70 - 130 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 20.0 | 22.8 | 114 | 70 - 130 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 18.6 | 21.8 | 118 | 70 - 130 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 20.0 | 23.0 | 115 | 70 - 130 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 18.8 | 21.1 | 112 | 70 - 130 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 20.0 | 23.6 | 118 | 70 - 130 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 20.0 | 23.4 | 117 | 70 - 130 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 20.0 | 23.4 | 117 | 70 - 130 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 20.0 | 23.5 | 117 | 70 - 130 |
| PFDoS | 79780-39-5 | 19.4 | 23.7 | 122 | 70 - 130 |
| PFHxDA | 67905-19-5 | 20.0 | 24.2 | 121 | 70 - 130 |
| PFODA | 16517-11-6 | 20.0 | 19.4 | 97 | 70 - 130 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | | |
| d3-NMeFOSAA | 2355-31-9-EIS | 250 | 221 | 89 | 50 - 150 |
| d5-NEtFOSAA | 2991-50-6-EIS | 250 | 249 | 100 | 50 - 150 |
| d7-NMeFOSE | 24448-09-7-EIS | 250 | 174 | 69 | 50 - 150 |
| d9-NEtFOSE | 1691-99-2-EIS | 250 | 171 | 69 | 50 - 150 |
| d-NEtFOSA | 4151-50-2-EIS | 250 | 117 | **47*** | 50 - 150 |
| d-NMeFOSA | 31506-32-8-EIS | 250 | 121 | **48*** | 50 - 150 |
| M2 4:2 FTS | 757124-72-4-EIS | 250 | 258 | 103 | 50 - 150 |
| M2 6:2 FTS | 27619-97-2-EIS | 250 | 296 | 119 | 50 - 150 |
| M2 8:2 FTS | 39108-34-4-EIS | 250 | 254 | 102 | 50 - 150 |
| M2PFHxDA | 67905-19-5-EIS | 250 | 282 | 113 | 50 - 150 |
| M2PFTA | 376-06-7-EIS | 250 | 234 | 94 | 50 - 150 |
| M3HFPODA | 13252-13-6-EIS | 250 | 278 | 111 | 50 - 150 |
| M3PFBS | 375-73-5-EIS | 250 | 243 | 97 | 50 - 150 |
| M3PFHxS | 355-46-4-EIS | 250 | 240 | 96 | 50 - 150 |
| M4PFHpA | 375-85-9-EIS | 250 | 244 | 97 | 50 - 150 |
| M5PFHxA | 307-24-4-EIS | 250 | 243 | 97 | 50 - 150 |
| M5PFPeA | 2706-90-3-EIS | 250 | 239 | 96 | 50 - 150 |

# LC-MS/MS QC Summary

| | | | | | |
|---|---|---|---|---|---|
| **Analytical Batch** | Client ID | LCS744694 | | | |
| 744833 | Lab ID | 2367072 | | | |
| **Prep Batch** | Sample Type | LCS | | | |
| 744694 | Prep Date | 07/05/22 12:30 | | | |
| **Prep Method** | Analysis Date | 07/07/22 02:20 | | | |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | | | |
| **PFAS Top Assay QSM B15 (Post)** | | Spike Added | Result | %R | Control Limits%R |
| M6PFDA | 335-76-2-EIS | 250 | 249 | 100 | 50 - 150 |
| M7PFUnA | 2058-94-8-EIS | 250 | 244 | 97 | 50 - 150 |
| M8FOSA | 754-91-6-EIS | 250 | 205 | 82 | 50 - 150 |
| M8PFOA | 335-67-1-EIS | 250 | 242 | 97 | 50 - 150 |
| M8PFOS | 1763-23-1-EIS | 250 | 241 | 97 | 50 - 150 |
| M9PFNA | 375-95-1-EIS | 250 | 244 | 98 | 50 - 150 |
| MPFBA | 375-22-4-EIS | 250 | 236 | 94 | 50 - 150 |
| MPFDoA | 307-55-1-EIS | 250 | 236 | 94 | 50 - 150 |
| MPFOA | 335-67-1-SUR | 500 | 488 | 98 | 50 - 150 |

# LC-MS/MS QC Summary

| | | | |
|---|---|---|---|
| **Analytical Batch** | Client ID | MB744694 | |
| 744833 | Lab ID | 2368945 | |
| **Prep Batch** | Sample Type | MB | |
| 744694 | Prep Date | 07/05/22 12:30 | |
| **Prep Method** | Analysis Date | 07/07/22 02:34 | |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | |
| **PFAS Top Assay QSM B15 (Post)** | | Units<br>Result | ng/L<br>DL |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 120226-60-0 | 4.25U | 4.25 |
| 11Cl-PF3OUdS | 763051-92-9 | 2.25U | 2.25 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 3.10U | 3.10 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 3.75U | 3.75 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 2.65U | 2.65 |
| 9Cl-PF3ONS | 756426-58-1 | 2.25U | 2.25 |
| ADONA | 919005-14-4 | 2.15U | 2.15 |
| NEtFOSA | 4151-50-2 | 3.50U | 3.50 |
| NEtFOSAA | 2991-50-6 | 3.95U | 3.95 |
| NEtFOSE | 1691-99-2 | 2.53U | 2.53 |
| NMeFOSA | 31506-32-8 | 4.15U | 4.15 |
| NMeFOSAA | 2355-31-9 | 2.25U | 2.25 |
| NMeFOSE | 24448-09-7 | 3.25U | 3.25 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 3.75U | 3.75 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 3.88U | 3.88 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 16.7U | 16.7 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 3.48U | 3.48 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 3.75U | 3.75 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1.55U | 1.55 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 3.80U | 3.80 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 3.05U | 3.05 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 3.60U | 3.60 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 3.25U | 3.25 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 3.05U | 3.05 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 2.90U | 2.90 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 3.10U | 3.10 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 2.35U | 2.35 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 4.35U | 4.35 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 2.45U | 2.45 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 1.85U | 1.85 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1.90U | 1.90 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 2.10U | 2.10 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 2.55U | 2.55 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 2.20U | 2.20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 2.85U | 2.85 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 3.08U | 3.08 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 3.10U | 3.10 |
| PFDoS | 79780-39-5 | 3.28U | 3.28 |
| PFHxDA | 67905-19-5 | 3.75U | 3.75 |
| PFODA | 16517-11-6 | 2.58U | 2.58 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** |
| d3-NMeFOSAA | 2355-31-9-EIS | 220 | 88 |
| d5-NEtFOSAA | 2991-50-6-EIS | 242 | 97 |
| d7-NMeFOSE | 24448-09-7-EIS | 188 | 75 |
| d9-NEtFOSE | 1691-99-2-EIS | 196 | 78 |
| d-NEtFOSA | 4151-50-2-EIS | 206 | 82 |
| d-NMeFOSA | 31506-32-8-EIS | 200 | 80 |
| M2 4:2 FTS | 757124-72-4-EIS | 264 | 106 |
| M2 6:2 FTS | 27619-97-2-EIS | 271 | 108 |
| M2 8:2 FTS | 39108-34-4-EIS | 246 | 98 |
| M2PFHxDA | 67905-19-5-EIS | 262 | 105 |
| M2PFTA | 376-06-7-EIS | 236 | 94 |
| M3HFPODA | 13252-13-6-EIS | 276 | 111 |
| M3PFBS | 375-73-5-EIS | 239 | 95 |
| M3PFHxS | 355-46-4-EIS | 244 | 98 |
| M4PFHpA | 375-85-9-EIS | 247 | 99 |
| M5PFHxA | 307-24-4-EIS | 244 | 98 |
| M5PFPeA | 2706-90-3-EIS | 242 | 97 |

# LC-MS/MS QC Summary

| | | | |
|---|---|---|---|
| **Analytical Batch** | Client ID | MB744694 | |
| 744833 | Lab ID | 2368945 | |
| **Prep Batch** | Sample Type | MB | |
| 744694 | Prep Date | 07/05/22 12:30 | |
| **Prep Method** | Analysis Date | 07/07/22 02:34 | |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | |
| **PFAS Top Assay QSM B15 (Post)** | | Units<br>Result | ng/L<br>DL |
| M6PFDA | 335-76-2-EIS | 252 | 101 |
| M7PFUnA | 2058-94-8-EIS | 249 | 100 |
| M8FOSA | 754-91-6-EIS | 226 | 90 |
| M8PFOA | 335-67-1-EIS | 244 | 97 |
| M8PFOS | 1763-23-1-EIS | 243 | 97 |
| M9PFNA | 375-95-1-EIS | 247 | 99 |
| MPFBA | 375-22-4-EIS | 229 | 91 |
| MPFDoA | 307-55-1-EIS | 235 | 94 |
| MPFOA | 335-67-1-SUR | 614 | 123 |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB744362 | LCS744362 | LCSD744362 |
|---|---|---|---|---|
| 744596 | Lab ID | 2365075 | 2365076 | 2365077 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 744362 | Prep Date | 06/29/22 15:38 | 06/29/22 15:38 | 06/29/22 15:38 |
| **Prep Method** | Analysis Date | 07/02/22 01:15 | 07/02/22 01:30 | 07/02/22 01:45 |
| PFAS Top Assay QSM B15 (Pre) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Pre)** | | Units Result | ng/L DL | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 120226-60-0 | 1.70U | 1.70 | 77.2 | 87.7 | 114 | 70 - 130 | 77.2 | 81.8 | 106 | 7 | 20 |
| 11Cl-PF3OUdS | 763051-92-9 | 0.900U | 0.900 | 75.4 | 79.7 | 106 | 70 - 130 | 75.4 | 78.0 | 103 | 2 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 1.24U | 1.24 | 75.0 | 76.2 | 102 | 70 - 130 | 75.0 | 74.7 | 100 | 2 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 1.50U | 1.50 | 76.1 | 85.7 | 113 | 70 - 130 | 76.1 | 82.0 | 108 | 4 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 1.06U | 1.06 | 76.8 | 89.0 | 116 | 70 - 130 | 76.8 | 81.1 | 106 | 9 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 0.900U | 0.900 | 74.6 | 81.3 | 109 | 70 - 130 | 74.6 | 79.2 | 106 | 3 | 20 |
| ADONA | 919005-14-4 | 0.860U | 0.860 | 75.6 | 80.9 | 107 | 70 - 130 | 75.6 | 77.8 | 103 | 4 | 20 |
| NEtFOSA | 4151-50-2 | 1.40U | 1.40 | 80.0 | 91.6 | 114 | 70 - 130 | 80.0 | 87.0 | 109 | 5 | 20 |
| NEtFOSAA | 2991-50-6 | 1.58U | 1.58 | 80.0 | 87.3 | 109 | 70 - 130 | 80.0 | 82.9 | 104 | 5 | 20 |
| NEtFOSE | 1691-99-2 | 1.01U | 1.01 | 80.0 | 95.9 | 120 | 70 - 130 | 80.0 | 98.3 | 123 | 3 | 20 |
| NMeFOSA | 31506-32-8 | 1.66U | 1.66 | 80.0 | 94.7 | 118 | 70 - 130 | 80.0 | 92.0 | 115 | 3 | 20 |
| NMeFOSAA | 2355-31-9 | 0.900U | 0.900 | 80.0 | 91.8 | 115 | 70 - 130 | 80.0 | 80.9 | 101 | 13 | 20 |
| NMeFOSE | 24448-09-7 | 1.30U | 1.30 | 80.0 | 91.7 | 115 | 70 - 130 | 80.0 | 95.0 | 119 | 4 | 20 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1.50U | 1.50 | 80.0 | 90.0 | 112 | 70 - 130 | 80.0 | 87.0 | 109 | 3 | 20 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1.55U | 1.55 | 71.2 | 81.6 | 115 | 70 - 130 | 71.2 | 78.6 | 110 | 4 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 6.67U | 6.67 | 160 | 184 | 115 | 70 - 130 | 160 | 180 | 113 | 2 | 20 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1.39U | 1.39 | 80.0 | 87.5 | 109 | 70 - 130 | 80.0 | 84.7 | 106 | 3 | 20 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1.50U | 1.50 | 80.0 | 90.4 | 113 | 70 - 130 | 80.0 | 84.5 | 106 | 7 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 0.620U | 0.620 | 71.0 | 78.0 | 110 | 70 - 130 | 71.0 | 76.0 | 107 | 3 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1.52U | 1.52 | 80.0 | 88.2 | 110 | 70 - 130 | 80.0 | 84.4 | 106 | 4 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 1.22U | 1.22 | 77.2 | 84.3 | 109 | 70 - 130 | 77.2 | 82.5 | 107 | 2 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1.44U | 1.44 | 80.0 | 90.6 | 113 | 70 - 130 | 80.0 | 88.1 | 110 | 3 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1.30U | 1.30 | 80.0 | 83.1 | 104 | 70 - 130 | 80.0 | 81.8 | 102 | 2 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1.22U | 1.22 | 76.2 | 84.5 | 111 | 70 - 130 | 76.2 | 81.5 | 107 | 4 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1.16U | 1.16 | 80.0 | 86.9 | 109 | 70 - 130 | 80.0 | 82.9 | 104 | 5 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1.24U | 1.24 | 73.1 | 79.4 | 109 | 70 - 130 | 73.1 | 77.0 | 105 | 3 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 0.940U | 0.940 | 80.0 | 89.4 | 112 | 70 - 130 | 80.0 | 83.4 | 104 | 7 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1.74U | 1.74 | 77.0 | 86.4 | 112 | 70 - 130 | 77.0 | 85.1 | 111 | 2 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 0.980U | 0.980 | 80.0 | 87.2 | 109 | 70 - 130 | 80.0 | 85.0 | 106 | 3 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 0.740U | 0.740 | 80.0 | 88.3 | 110 | 70 - 130 | 80.0 | 84.5 | 106 | 4 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 0.760U | 0.760 | 74.2 | 81.9 | 110 | 70 - 130 | 74.2 | 78.1 | 105 | 5 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 0.840U | 0.840 | 80.0 | 86.0 | 107 | 70 - 130 | 80.0 | 82.5 | 103 | 4 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1.02U | 1.02 | 75.3 | 81.8 | 109 | 70 - 130 | 75.3 | 79.9 | 106 | 2 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 0.880U | 0.880 | 80.0 | 87.4 | 109 | 70 - 130 | 80.0 | 84.2 | 105 | 4 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 1.14U | 1.14 | 80.0 | 84.7 | 106 | 70 - 130 | 80.0 | 82.1 | 103 | 3 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1.23U | 1.23 | 80.0 | 84.0 | 105 | 70 - 130 | 80.0 | 82.6 | 103 | 2 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1.24U | 1.24 | 80.0 | 87.9 | 110 | 70 - 130 | 80.0 | 87.3 | 109 | 1 | 20 |
| PFDoS | 79780-39-5 | 1.31U | 1.31 | 77.6 | 86.1 | 111 | 70 - 130 | 77.6 | 82.8 | 107 | 4 | 20 |
| PFHxDA | 67905-19-5 | 1.50U | 1.50 | 80.0 | 86.5 | 108 | 70 - 130 | 80.0 | 82.3 | 103 | 5 | 20 |
| PFODA | 16517-11-6 | 1.03U | 1.03 | 80.0 | 78.7 | 98 | 70 - 130 | 80.0 | 73.2 | 91 | 7 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 88.4 | 88 | 100 | 89.1 | 89 | 50 - 150 | 100 | 94 | 94 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 92.2 | 92 | 100 | 94.4 | 94 | 50 - 150 | 100 | 92.1 | 92 | NA | NA |
| d7-NMeFOSE | 24448-09-7-EIS | 54.4 | 54 | 100 | 47.6 | 48* | 50 - 150 | 100 | 53.3 | 53 | NA | NA |
| d9-NEtFOSE | 1691-99-2-EIS | 62.6 | 63 | 100 | 53.8 | 54 | 50 - 150 | 100 | 58 | 58 | NA | NA |
| d-NEtFOSA | 4151-50-2-EIS | 71.1 | 71 | 100 | 61.8 | 62 | 50 - 150 | 100 | 68.5 | 68 | NA | NA |
| d-NMeFOSA | 31506-32-8-EIS | 67.5 | 67 | 100 | 57.7 | 58 | 50 - 150 | 100 | 63.1 | 63 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 88 | 88 | 100 | 90.3 | 90 | 50 - 150 | 100 | 89 | 89 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 94.8 | 95 | 100 | 94 | 94 | 50 - 150 | 100 | 93.6 | 94 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 85.9 | 86 | 100 | 83.2 | 83 | 50 - 150 | 100 | 87.6 | 88 | NA | NA |
| M2PFHxDA | 67905-19-5-EIS | 85.6 | 86 | 100 | 94.4 | 94 | 50 - 150 | 100 | 93.3 | 93 | NA | NA |
| M2PFTA | 376-06-7-EIS | 88.4 | 88 | 100 | 88.1 | 88 | 50 - 150 | 100 | 88 | 88 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 94.5 | 94 | 100 | 97 | 97 | 50 - 150 | 100 | 94.5 | 95 | NA | NA |
| M3PFBS | 375-73-5-EIS | 90.8 | 91 | 100 | 92.2 | 92 | 50 - 150 | 100 | 91.3 | 91 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 90.5 | 91 | 100 | 92.3 | 92 | 50 - 150 | 100 | 91.7 | 92 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 94.7 | 95 | 100 | 94.6 | 95 | 50 - 150 | 100 | 94.5 | 95 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 91.4 | 91 | 100 | 91.9 | 92 | 50 - 150 | 100 | 93.2 | 93 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 89.2 | 89 | 100 | 91 | 91 | 50 - 150 | 100 | 90.3 | 90 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB744362 | | LCS744362 | | | | LCSD744362 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 744596 | Lab ID | 2365075 | | 2365076 | | | | 2365077 | | | | |
| **Prep Batch** | Sample Type | MB | | LCS | | | | LCSD | | | | |
| 744362 | Prep Date | 06/29/22 15:38 | | 06/29/22 15:38 | | | | 06/29/22 15:38 | | | | |
| **Prep Method** | Analysis Date | 07/02/22 01:15 | | 07/02/22 01:30 | | | | 07/02/22 01:45 | | | | |
| PFAS Top Assay QSM B15 (Pre) | Matrix | Water | | Water | | | | Water | | | | |
| **PFAS Top Assay QSM B15 (Pre)** | | Units Result | ng/L DL | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
| M6PFDA | 335-76-2-EIS | 89.9 | 90 | 100 | 90.6 | 91 | 50 - 150 | 100 | 89.4 | 89 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 94.5 | 94 | 100 | 92.6 | 93 | 50 - 150 | 100 | 90.2 | 90 | NA | NA |
| M8FOSA | 754-91-6-EIS | 82.8 | 83 | 100 | 83.1 | 83 | 50 - 150 | 100 | 83.5 | 84 | NA | NA |
| M8PFOA | 335-67-1-EIS | 94.5 | 94 | 100 | 95.7 | 96 | 50 - 150 | 100 | 94.7 | 95 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 88.2 | 88 | 100 | 90.7 | 91 | 50 - 150 | 100 | 89.2 | 89 | NA | NA |
| M9PFNA | 375-95-1-EIS | 92.8 | 93 | 100 | 92.7 | 93 | 50 - 150 | 100 | 91.6 | 92 | NA | NA |
| MPFBA | 375-22-4-EIS | 91 | 91 | 100 | 91.9 | 92 | 50 - 150 | 100 | 91.5 | 91 | NA | NA |
| MPFDoA | 307-55-1-EIS | 95.2 | 95 | 100 | 93.2 | 93 | 50 - 150 | 100 | 90.7 | 91 | NA | NA |
| MPFOA | 335-67-1-SUR | 222 | 111 | 200 | 225 | 113 | 50 - 150 | 200 | 216 | 108 | NA | NA |

# General Chemistry QC Summary

| Analytical Batch | Client ID | MB743676 | | LCS743676 | | | | LCSD743676 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 743676 | Lab ID | 2361285 | | 2361286 | | | | 2361287 | | | | |
| | Sample Type | MB | | LCS | | | | LCSD | | | | |
| | Prep Date | NA | | NA | | | | NA | | | | |
| | Analysis Date | 06/21/22 18:21 | | 06/21/22 17:29 | | | | 06/21/22 22:47 | | | | |
| | Matrix | Water | | Water | | | | Water | | | | |
| **SM 5310 B-2014** | | Units Result | mg/L DL | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
| Total Organic Carbon | C-012 | 0.300U | 0.300 | 50.0 | 48.8 | 98 | 90 - 110 | 50.0 | 49.1 | 98 | 1 | 20 |

# Top Assay Pre/Post Summary

| **Client ID** | CMT-VRTB-01_1_0615202 | | | |
|---|---|---|---|---|
| **LAB ID** | 22206182001 | | | |
| **Collected** | 06/14/22 15:25 | | | |
| **Matrix** | Water | | | |
| **Units** | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 4.25U | 4.25U | 0 | 0 |
| 11Cl-PF3OUdS | 2.25U | 2.25U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 3.10U | 3.10U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 3.75U | 3.75U | 0 | 0 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 2.65U | 2.65U | 0 | 0 |
| 9Cl-PF3ONS | 2.25U | 2.25U | 0 | 0 |
| ADONA | 2.15U | 2.15U | 0 | 0 |
| NEtFOSA | 3.50U | 3.50U | 0 | 0 |
| NEtFOSAA | 3.95U | 3.95U | 0 | 0 |
| NEtFOSE | 2.53U | 2.53U | 0 | 0 |
| NMeFOSA | 4.15U | 4.15U | 0 | 0 |
| NMeFOSAA | 2.25U | 2.25U | 0 | 0 |
| NMeFOSE | 3.25U | 3.25U | 0 | 0 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 3.75U | 3.75U | 0 | 0 |
| PFDoS | 3.28U | 3.28U | 0 | 0 |
| PFHxDA | 3.75U | 3.75U | 0 | 0 |
| PFODA | 2.58U | 2.58U | 0 | 0 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 3.88U | 3.88U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 16.7U | 16.7U | 0 | 0 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 3.48U | 3.48U | 0 | 0 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 3.75U | 3.75U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 6.56J | 5.62J | -0.94 | 15.4 |
| Perfluorobutanoic acid (PFBA) | 13.1 | 15.8 | 2.7 | 18.7 |
| Perfluorodecane sulfonic acid (PFDS) | 3.05U | 3.05U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 3.60U | 3.60U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 3.25U | 3.25U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 5.97J | 5.58J | -0.39 | 6.8 |
| Perfluoroheptanoic acid (PFHpA) | 81.5 | 75.4 | -6.1 | 7.8 |
| Perfluorohexanesulfonic acid (PFHxS) | 58.1 | 52.3 | -5.8 | 10.5 |
| Perfluorohexanoic acid (PFHxA) | 32.7 | 74.8 | 42.1 | 78.3 |
| Perfluorononanesulfonic acid (PFNS) | 4.35U | 4.35U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 2.45U | 2.45U | 0 | 0 |
| Perfluorooctane Sulfonamide (FOSA) | 1.85U | 1.85U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 243 | 171 | -72 | 34.8 |
| Perfluorooctanoic acid (PFOA) | 55.7 | 50.8 | -4.9 | 9.2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2.72J | 2.55U | -2.72 | 200 |
| Perfluoropentanoic acid (PFPeA) | 40.5 | 48.7 | 8.2 | 18.4 |
| Perfluorotetradecanoic acid (PFTA) | 2.85U | 2.85U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 3.08U | 3.08U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 3.10U | 3.10U | 0 | 0 |

Client ID: 4367 - Pace Analytical Services
SDG: 222061820
PM: RWe

Chain of Custody

Pace Analytical
www.pacelabs.com

Workorder: XF17016 Workorder Name: ESTCP Vertebrae Owner Received Date: 6/17/2022 Results Requested By: 6/29/2022

| Report To: | Subcontract To: | Requested Analysis |
|---|---|---|
| Kathy E. Smith<br>Pace Analytical<br>106 Vantage Point Drive<br>Columbia SC, 29223<br>803-227-2704<br>Kathy.Smith@pacelabs.com | Project #<br><br>Pace Gulf Coast<br>7979 Innovation Park Drive,<br>Baton Rouge, LA 70820 | |

| Item | Sample ID | Sample Type | Collect Date/Time | Lab ID | Matrix | Preserved Containers | TOP ASSAY | TOC | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CMT-VRTB-01_1_0615202 | grab | 06/14/2022 @ 1525 | XF17016-008 | Aqueous | | x | | 1 |
| 2 | VRTB-S-M5_06162022 | grab | 06/14/2022 @ 0905 | XF17016-015 | Aqueous | | | x | 2 |
| 3 | VRTB-S-R7_06162022 | grab | 06/14/2022 @ 1120 | XF17016-017 | Aqueous | | | x | 3 |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |

| Transfers | Released By | Date/Time | Reveived By | Date/Time | Comments |
|---|---|---|---|---|---|
| 1 | | | | | 0.4 EH2<br>1663 3467 2513 |
| 2 | | | | | |
| 3 | FedEx | 6/17/22 1800 | | 6/18/22 12:16 | |

| Cooler Temperature on Receipt _____ °C | Custody Seal Y or N | Received on Ice Y or N | Sample Intact Y or N |
|---|---|---|---|

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC
This chain of custody is considered complete as is since this information is available in the owner laboratory.

# SAMPLE RECEIVING CHECKLIST

| SAMPLE DELIVERY GROUP 222061820 | |
|---|---|
| **Client** **PM** RWe<br>4367 - Pace Analytical Services | **Transport Method**<br>FEDEX |
| **Profile Number**<br>294461 | **Received By**<br>McCune, Dodie N. |
| **Line Item(s)**<br>1 - Top Assay Soil<br>6 - TOC | **Receive Date(s)**<br>06/18/22 |

| CHECKLIST | YES | NO |
|---|---|---|
| Samples received with proper thermal preservation? | ☑ | ☐ |
| Radioactivity is <1600 cpm? If no, record cpm value in notes section. | ☑ | ☐ |
| COC relinquished and complete (including sampleIDs, collect times, and sampler)? | ☑ | ☐ |
| All containers received in good condition and within hold time? | ☑ | ☐ |
| All sample labels and containers received match the chain of custody? | ☑ | ☐ |
| Preservative added to any containers? | ☐ | ☑ |
| If received, was headspace for VOC water containers < 6mm? | ☑ | ☐ |
| Samples collected in containers provided by Pace Gulf Coast? | ☐ | ☑ |

**COOLERS**

| Airbill | Thermometer ID: E42 | Temp °C |
|---|---|---|
| 166334672513 | | 0.4 |

**DISCREPANCIES**

None

**LAB PRESERVATIONS**

None

**NOTES**

Revision 1.6

# Performance Monitoring Event #4

*LELAP Certificate Number: 01955*
*A2LA Accredited (DoD ELAP-QSM 5.4) Certificate Number: 6429.01*

# ANALYTICAL RESULTS

**PERFORMED BY**

**Pace Analytical Gulf Coast**
**7979 Innovation Park Dr.**
**Baton Rouge, LA 70820**
**(225) 769-4900**

**Report Date** 10/21/2022

**Report #** 222083141

***Project*** XH26042 ESTCP Vertebrae

**Samples Collected** 8/25/22

| ***Deliver To*** | ***Additional Recipients*** |
|---|---|
| Kathy Smith<br>Pace Analytical<br>106 Vantage Point Drive<br>Columbia, SC 29223<br>803-227-2704 | NONE |

A2LA ACCREDITED
CERT # 6429.01

# Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with Pace Gulf Coast's Standard Operating Procedures.

**Common Abbreviations that may be Utilized in this Report**

| | |
|---|---|
| **ND** | Indicates the result was Not Detected at the specified reporting limit |
| **NO** | Indicates the sample did not ignite when preliminary test performed for EPA Method 1030 |
| **DO** | Indicates the result was Diluted Out |
| **MI** | Indicates the result was subject to Matrix Interference |
| **TNTC** | Indicates the result was Too Numerous To Count |
| **SUBC** | Indicates the analysis was Sub-Contracted |
| **FLD** | Indicates the analysis was performed in the Field |
| **DL** | Detection Limit |
| **LOD** | Limit of Detection |
| **LOQ** | Limit of Quantitation |
| **RE** | Re-analysis |
| **CF** | HPLC or GC Confirmation |
| **00:01** | Reported as a time equivalent to 12:00 AM |

**Reporting Flags that may be Utilized in this Report**

| | |
|---|---|
| **J or I** | Indicates the result is between the MDL and LOQ |
| **J** | DOD flag on analyte in the parent sample for MS/MSD outside acceptance criteria |
| **U** | Indicates the compound was analyzed for but not detected |
| **B or V** | Indicates the analyte was detected in the associated Method Blank |
| **Q** | Indicates a non-compliant QC Result (See Q Flag Application Report) |
| ***** | Indicates a non-compliant or not applicable QC recovery or RPD – see narrative |
| **E** | Organics **-** The result is estimated because it exceeded the instrument calibration range |
| **E** | Metals - % diference for the serial dilution is > 10% |
| **L** | Reporting Limits adjusted to meet risk-based limit. |
| **P** | RPD between primary and confirmation result is greater than 40 |
| **DL** | Diluted analysis – when appended to Client Sample ID |

Sample receipt at Pace Gulf Coast is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of Pace Gulf Coast. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with The NELAC Institute (TNI) Standard 2009 and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.



Authorized Signature
Pace Gulf Coast Report 222083141

# Certifications

| Certification | Certification Number |
|---|---|
| A2LA Accredited (DoD ELAP-QSM 5.4) | 6429.01 |
| Alabama | 01955 |
| Arkansas | 88-0655 |
| Colorado | 01955 |
| Delaware | 01955 |
| Florida | E87854 |
| Georgia | 01955 |
| Hawaii | 01955 |
| Idaho | 01955 |
| Illinois | 200048 |
| Indiana | 01955 |
| Kansas | E-10354 |
| Kentucky | 95 |
| Louisiana | 01955 |
| Maryland | 01955 |
| Massachusetts | 01955 |
| Michigan | 01955 |
| Mississippi | 01955 |
| Missouri | 01955 |
| Montana | N/A |
| Nebraska | 01955 |
| New Mexico | 01955 |
| North Carolina | 618 |
| North Dakota | R-195 |
| Oklahoma | 9403 |
| South Carolina | 73006001 |
| South Dakota | 01955 |
| Tennessee | 01955 |
| Texas | T104704178 |
| Vermont | 01955 |
| Virginia | 460215 |
| Washington | C929 |
| USDA Soil Permit | P330-16-00234 |

# Case Narrative

**Client:** Pace Analytical Services **Report:** 222083141

Pace Analytical Gulf Coast received and analyzed the sample(s) listed
on the Report Sample Summary page of this report. Receipt of the sample(s) is documented
by the attached chain of custody. This applies only to the sample(s) listed in this report.
No sample integrity or quality control exceptions were identified unless noted below.

This report was completed in accordance with DOD QSM 5.3 as specified in the contract.

**SEMI-VOLATILES MASS SPECTROMETRY**

Samples 22208314101 () and 22208314102 (CMT-VRTB-01_3_08252022) were re-extracted outside holding time due to the original extract being unnecessarily diluted 1:1000

In the PFAS Top Assay QSM B15 (Pre) analysis, the recovery for the extracted internal standard d-NEtFOSA and d-NMeFOSA is outside the control limits for sample 2400713 (MB for HBN 750661 [LCMS/6658]) .

In the PFAS Top Assay QSM B15 (Pre) analysis, the recovery for the extracted internal standard d-NEtFOSA, d-NMeFOSA and d9-NEtFOSE is outside the control limits for sample 22208314102 (CMT-VRTB-01_3_08252022) .

In the PFAS Top Assay QSM B15 (Post) analysis, the recovery for the extracted internal standard d-NEtFOSA and d-NMeFOSA is outside the control limits for sample 2393264 (MB for HBN 749316 [LCMS/6523]) .

In the PFAS Top Assay QSM B15 (Post) analysis, the recovery for the extracted internal standard d-NEtFOSA, d-NMeFOSA and M2PFHxDA is outside the control limits for sample 2393266 (LCSD for HBN 749316 [LCMS/6523) .

In the PFAS Top Assay QSM B15 (Post) analysis, the recovery for the extracted internal standard M2 4:2 FTS is above the upper control limits for sample 2393267 (VESBK for HBN 749316 [LCMS/652) . There are no target hits for the associated compounds.

In the PFAS Top Assay QSM B15 (Post) analysis, the recovery for the extracted internal standard M2 6:2 FTS is above the upper control limits for sample 2393267 (VESBK for HBN 749316 [LCMS/652) . There are no target hits for the associated compounds.

In the PFAS Top Assay QSM B15 (Post) analysis, the recovery for the extracted internal standard M2 8:2 FTS is above the upper control limits for sample 2393267 (VESBK for HBN 749316 [LCMS/652) . There are no target hits for the associated compounds.

In the PFAS Top Assay QSM B15 (Post) analysis, the recovery for the extracted internal standard M2PFHxDA is above the upper control limits for sample 2393267 (VESBK for HBN 749316 [LCMS/652) . There are no target hits for the associated compounds.

In the PFAS Top Assay QSM B15 (Post) analysis for prep batch 749316, the LCS and/or LCSD recoveries are outside control limits for PFODA.

In the PFAS Top Assay QSM B15 (Post) analysis for prep batch 749316, the LCS and/or LCSD recoveries are above the upper control limits for NMeFOSA. This analyte was not detected in the associated samples.

In the PFAS Top Assay QSM B15 (Pre) analysis for prep batch 749157, the LCS/LCSD RPD is above the control limit for NEtFOSE.

In the PFAS Top Assay QSM B15 (Post) analysis for prep batch 749316, the LCS/LCSD RPD is above the control limit for PFODA.

# Sample Summary

| Lab ID | Client ID | Matrix | Collect Date | Receive Date |
|---|---|---|---|---|
| 22208314101 | CMT-VRTB-01_2_08252022 | Water | 8/25/22 09:05 | 8/31/22 09:27 |
| 22208314102 | CMT-VRTB-01_3_08252022 | Water | 8/25/22 09:55 | 8/31/22 09:27 |

# Test Summary

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Matrix | Batch | Instru | RunDate |
|---|---|---|---|---|---|
| 22208314101 | CMT-VRTB-01_2_08252022 | Water | 749762 | QQQ5 | 9/15/22 10:40 |
| 22208314102 | CMT-VRTB-01_3_08252022 | Water | 751527 | QQQ5 | 10/11/22 02:14 |

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Matrix | Batch | Instru | RunDate |
|---|---|---|---|---|---|
| 22208314101 | CMT-VRTB-01_2_08252022 | Water | 750001 | QQQ4 | 9/17/22 06:18 |
| 22208314102 | CMT-VRTB-01_3_08252022 | Water | 751501 | QQQ4 | 10/10/22 15:21 |

# Manual Integrations

Manual Integrations for LC and IC (if performed) are documented in the raw data.
No other manual integrations were performed by Pace Gulf Coast.

# Q Flag Summary

Client Sample ID: **CMT-VRTB-01_2_08252022** Lab Sample ID: **22208314101**

| **PFAS Top Assay QSM B15 (Pre) Analysis Date: 9/15/2022 10:40:56 AM** | | | | | | |
|---|---|---|---|---|---|---|
| **CAS** | **Analyte** | **CCV** | **LCS/D** | **SURR** | **ISTD** | **CLCCV** |
| 1691-99-2 | NEtFOSE | | X | | | |
| **PFAS Top Assay QSM B15 (Post) Analysis Date: 9/17/2022 6:18:27 AM** | | | | | | |
| **CAS** | **Analyte** | **CCV** | **LCS/D** | **SURR** | **ISTD** | **CLCCV** |
| 31506-32-8 | NMeFOSA | | X | | | |
| 16517-11-6 | PFODA | | X | | | |

CCV=Initial or Continuing CCV out of limits
LCS/D=LCS/LCSD out of limits
SURR=Surrogate out of limits
ISTD=Internal Standard out of limits
CLCCV=Closing CCV out of limits

# Detect Summary

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22208314101 | CMT-VRTB-01_2_08252022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 6380J | 1 | NA |
| 22208314101 | CMT-VRTB-01_2_08252022 | Perfluorohexanoic acid (PFHxA) | ng/L | 11300 | 1 | NA |
| 22208314101 | CMT-VRTB-01_2_08252022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 57100 | 1 | NA |
| 22208314101 | CMT-VRTB-01_2_08252022 | Perfluoropentanoic acid (PFPeA) | ng/L | 3450J | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 8.60J | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorobutanoic acid (PFBA) | ng/L | 60.2 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 17.0 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 29.6 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 400 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorohexanoic acid (PFHxA) | ng/L | 419 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorononanoic acid (PFNA) | ng/L | 13.3 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorooctane Sulfonamide (FOSA) | ng/L | 2.04J | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 2180 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorooctanoic acid (PFOA) | ng/L | 54.0 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 11.4 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluoropentanoic acid (PFPeA) | ng/L | 98.1 | 1 | NA |

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22208314101 | CMT-VRTB-01_2_08252022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 6400J | 1 | NA |
| 22208314101 | CMT-VRTB-01_2_08252022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 64200 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 24.9 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 11.0 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 10.7 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorobutanoic acid (PFBA) | ng/L | 12.5 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 21.0 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 25.3 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 453 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorohexanoic acid (PFHxA) | ng/L | 25.1 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorononanoic acid (PFNA) | ng/L | 17.4 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 2730 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluorooctanoic acid (PFOA) | ng/L | 61.2 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 14.0 | 1 | NA |
| 22208314102 | CMT-VRTB-01_3_08252022 | Perfluoropentanoic acid (PFPeA) | ng/L | 19.9 | 1 | NA |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_2_08252022** | **Collect Date** | 08/25/2022 09:05 | **Lab ID** | 22208314101 |
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 09/07/22 19:56 | 749157 | PFAS Top Assay QSM B15 (Pre) | 1 | 09/15/22 10:40 | 749762 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8750U | 4250 | 8750 | 10000 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5000U | 2250 | 5000 | 10000 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7500U | 3100 | 7500 | 10000 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7500U | 3750 | 7500 | 10000 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7500U | 2650 | 7500 | 10000 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5000U | 2250 | 5000 | 10000 | ng/L |
| 919005-14-4 | ADONA | 5000U | 2150 | 5000 | 10000 | ng/L |
| 4151-50-2 | NEtFOSA | 10000U | 3500 | 10000 | 20000 | ng/L |
| 2991-50-6 | NEtFOSAA | 10000U | 3950 | 10000 | 20000 | ng/L |
| 1691-99-2 | NEtFOSE | 10000UQ | 2530 | 10000 | 20000 | ng/L |
| 31506-32-8 | NMeFOSA | 10000U | 4150 | 10000 | 20000 | ng/L |
| 2355-31-9 | NMeFOSAA | 10000U | 2250 | 10000 | 20000 | ng/L |
| 24448-09-7 | NMeFOSE | 10000U | 3250 | 10000 | 20000 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8750U | 3750 | 8750 | 10000 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8750U | 3880 | 8750 | 10000 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37500U | 16700 | 37500 | 50000 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7500U | 3480 | 7500 | 10000 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8750U | 3750 | 8750 | 10000 | ng/L |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 5000U | 1550 | 5000 | 10000 | ng/L |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 8750U | 3800 | 8750 | 10000 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7500U | 3050 | 7500 | 10000 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7500U | 3600 | 7500 | 10000 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7500U | 3250 | 7500 | 10000 | ng/L |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 7500U | 3050 | 7500 | 10000 | ng/L |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 7500U | 2900 | 7500 | 10000 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **6400J** | 3100 | 7500 | 10000 | ng/L |
| 307-24-4 | Perfluorohexanoic acid (PFHxA) | 5000U | 2350 | 5000 | 10000 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8750U | 4350 | 8750 | 10000 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 5000U | 2450 | 5000 | 10000 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5000U | 1850 | 5000 | 10000 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **64200** | 1900 | 5000 | 10000 | ng/L |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 5000U | 2100 | 5000 | 10000 | ng/L |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 7500U | 2550 | 7500 | 10000 | ng/L |
| 2706-90-3 | Perfluoropentanoic acid (PFPeA) | 5000U | 2200 | 5000 | 10000 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7500U | 2850 | 7500 | 10000 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7500U | 3080 | 7500 | 10000 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7500U | 3100 | 7500 | 10000 | ng/L |
| 79780-39-5 | PFDoS | 7500U | 3280 | 7500 | 10000 | ng/L |
| 67905-19-5 | PFHxDA | 8750U | 3750 | 8750 | 10000 | ng/L |

# Sample Results

| **CMT-VRTB-01_2_08252022** | **Collect Date** | 08/25/2022 09:05 | **Lab ID** | 22208314101 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 09/07/22 19:56 | 749157 | PFAS Top Assay QSM B15 (Pre) | 1 | 09/15/22 10:40 | 749762 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7500U | 2580 | 7500 | 10000 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500000 | 602000 | ng/L | 120 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250000 | 184000 | ng/L | 73 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250000 | 189000 | ng/L | 76 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250000 | 276000 | ng/L | 111 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250000 | 303000 | ng/L | 121 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250000 | 256000 | ng/L | 102 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250000 | 237000 | ng/L | 95 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250000 | 285000 | ng/L | 114 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250000 | 289000 | ng/L | 116 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250000 | 324000 | ng/L | 130 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250000 | 273000 | ng/L | 109 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250000 | 280000 | ng/L | 112 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250000 | 281000 | ng/L | 112 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250000 | 290000 | ng/L | 116 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250000 | 285000 | ng/L | 114 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250000 | 285000 | ng/L | 114 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250000 | 292000 | ng/L | 117 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250000 | 290000 | ng/L | 116 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250000 | 293000 | ng/L | 117 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250000 | 301000 | ng/L | 120 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250000 | 262000 | ng/L | 105 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250000 | 284000 | ng/L | 114 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250000 | 282000 | ng/L | 113 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250000 | 291000 | ng/L | 116 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250000 | 292000 | ng/L | 117 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250000 | 276000 | ng/L | 111 | 50 - 150 |

# Sample Results

| **CMT-VRTB-01_2_08252022** | **Collect Date** | 08/25/2022 09:05 | **Lab ID** | 22208314101 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 09/12/22 13:00 | 749316 | PFAS Top Assay QSM B15 (Post) | 1 | 09/17/22 06:18 | 750001 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8750U | 4250 | 8750 | 10000 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5000U | 2250 | 5000 | 10000 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7500U | 3100 | 7500 | 10000 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7500U | 3750 | 7500 | 10000 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7500U | 2650 | 7500 | 10000 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5000U | 2250 | 5000 | 10000 | ng/L |
| 919005-14-4 | ADONA | 5000U | 2150 | 5000 | 10000 | ng/L |
| 4151-50-2 | NEtFOSA | 10000U | 3500 | 10000 | 20000 | ng/L |
| 2991-50-6 | NEtFOSAA | 10000U | 3950 | 10000 | 20000 | ng/L |
| 1691-99-2 | NEtFOSE | 10000U | 2530 | 10000 | 20000 | ng/L |
| 31506-32-8 | NMeFOSA | 10000UQ | 4150 | 10000 | 20000 | ng/L |
| 2355-31-9 | NMeFOSAA | 10000U | 2250 | 10000 | 20000 | ng/L |
| 24448-09-7 | NMeFOSE | 10000U | 3250 | 10000 | 20000 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8750U | 3750 | 8750 | 10000 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8750U | 3880 | 8750 | 10000 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37500U | 16700 | 37500 | 50000 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7500U | 3480 | 7500 | 10000 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8750U | 3750 | 8750 | 10000 | ng/L |
| 375-73-5 | Perfluorobutanesulfonic acid (PFBS) | 5000U | 1550 | 5000 | 10000 | ng/L |
| 375-22-4 | Perfluorobutanoic acid (PFBA) | 8750U | 3800 | 8750 | 10000 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7500U | 3050 | 7500 | 10000 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7500U | 3600 | 7500 | 10000 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7500U | 3250 | 7500 | 10000 | ng/L |
| 375-92-8 | Perfluoroheptanesulfonic acid (PFHpS) | 7500U | 3050 | 7500 | 10000 | ng/L |
| 375-85-9 | Perfluoroheptanoic acid (PFHpA) | 7500U | 2900 | 7500 | 10000 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **6380J** | 3100 | 7500 | 10000 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **11300** | 2350 | 5000 | 10000 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8750U | 4350 | 8750 | 10000 | ng/L |
| 375-95-1 | Perfluorononanoic acid (PFNA) | 5000U | 2450 | 5000 | 10000 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5000U | 1850 | 5000 | 10000 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **57100** | 1900 | 5000 | 10000 | ng/L |
| 335-67-1 | Perfluorooctanoic acid (PFOA) | 5000U | 2100 | 5000 | 10000 | ng/L |
| 2706-91-4 | Perfluoropentanesulfonic acid (PFPeS) | 7500U | 2550 | 7500 | 10000 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **3450J** | 2200 | 5000 | 10000 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7500U | 2850 | 7500 | 10000 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7500U | 3080 | 7500 | 10000 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7500U | 3100 | 7500 | 10000 | ng/L |
| 79780-39-5 | PFDoS | 7500U | 3280 | 7500 | 10000 | ng/L |
| 67905-19-5 | PFHxDA | 8750U | 3750 | 8750 | 10000 | ng/L |

# Sample Results

| **CMT-VRTB-01_2_08252022** | **Collect Date** | 08/25/2022 09:05 | **Lab ID** | 22208314101 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 09/12/22 13:00 | 749316 | PFAS Top Assay QSM B15 (Post) | 1 | 09/17/22 06:18 | 750001 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7500UQ | 2580 | 7500 | 10000 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500000 | 544000 | ng/L | 109 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250000 | 249000 | ng/L | 100 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250000 | 253000 | ng/L | 101 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250000 | 251000 | ng/L | 101 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250000 | 265000 | ng/L | 106 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250000 | 252000 | ng/L | 101 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250000 | 238000 | ng/L | 95 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250000 | 279000 | ng/L | 111 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250000 | 308000 | ng/L | 123 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250000 | 294000 | ng/L | 118 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250000 | 292000 | ng/L | 117 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250000 | 250000 | ng/L | 100 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250000 | 275000 | ng/L | 110 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250000 | 272000 | ng/L | 109 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250000 | 269000 | ng/L | 107 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250000 | 279000 | ng/L | 112 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250000 | 276000 | ng/L | 110 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250000 | 276000 | ng/L | 110 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250000 | 283000 | ng/L | 113 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250000 | 276000 | ng/L | 111 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250000 | 253000 | ng/L | 101 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250000 | 280000 | ng/L | 112 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250000 | 255000 | ng/L | 102 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250000 | 267000 | ng/L | 107 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250000 | 186000 | ng/L | 74 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250000 | 269000 | ng/L | 108 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_3_08252022** | **Collect Date** | 08/25/2022 09:55 | **Lab ID** | 22208314102 |
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 02:14 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **24.9** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **11.0** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **10.7** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **12.5** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **21.0** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **25.3** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **453** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **25.1** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **17.4** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **2730** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **61.2** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **14.0** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **19.9** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **CMT-VRTB-01_3_08252022** | **Collect Date** | 08/25/2022 09:55 | **Lab ID** | 22208314102 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 02:14 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 377 | ng/L | 75 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 108 | ng/L | **43*** | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 118 | ng/L | **47*** | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 177 | ng/L | 71 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 195 | ng/L | 78 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 131 | ng/L | 52 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 123 | ng/L | **49*** | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 184 | ng/L | 74 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 167 | ng/L | 67 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 164 | ng/L | 66 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 200 | ng/L | 80 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 185 | ng/L | 74 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 173 | ng/L | 69 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 183 | ng/L | 73 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 180 | ng/L | 72 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 190 | ng/L | 76 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 185 | ng/L | 74 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 183 | ng/L | 73 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 197 | ng/L | 79 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 194 | ng/L | 78 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 166 | ng/L | 67 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 189 | ng/L | 76 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 175 | ng/L | 70 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 184 | ng/L | 74 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 180 | ng/L | 72 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 185 | ng/L | 74 | 50 - 150 |

# Sample Results

| | | | | | |
|---|---|---|---|---|---|
| **CMT-VRTB-01_3_08252022** | **Collect Date** | 08/25/2022 09:55 | **Lab ID** | 22208314102 |
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 15:21 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **8.60J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **60.2** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **17.0** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **29.6** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **400** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **419** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **13.3** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | **Perfluorooctane Sulfonamide (FOSA)** | **2.04J** | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **2180** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **54.0** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **11.4** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **98.1** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **CMT-VRTB-01_3_08252022** | **Collect Date** | 08/25/2022 09:55 | **Lab ID** | 22208314102 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 15:21 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 446 | ng/L | 89 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 191 | ng/L | 76 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 188 | ng/L | 75 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 249 | ng/L | 100 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 276 | ng/L | 110 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 189 | ng/L | 76 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 190 | ng/L | 76 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 270 | ng/L | 108 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 249 | ng/L | 99 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 218 | ng/L | 87 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 266 | ng/L | 106 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 242 | ng/L | 97 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 325 | ng/L | 130 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 261 | ng/L | 104 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 258 | ng/L | 103 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 279 | ng/L | 112 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 277 | ng/L | 111 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 262 | ng/L | 105 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 287 | ng/L | 115 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 243 | ng/L | 97 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 265 | ng/L | 106 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 264 | ng/L | 106 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 237 | ng/L | 95 | 50 - 150 |

# LC-MS/MS QC Summary

| **Analytical Batch** | | MB749316 | | LCS749316 | | | | LCSD749316 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 750001 | Client ID | 2393264 | | 2393265 | | | | 2393266 | | | | |
| **Prep Batch** | Lab ID | MB | | LCS | | | | LCSD | | | | |
| 749316 | Sample Type | 09/12/22 | | 09/12/22 13:00 | | | | 09/12/22 13:00 | | | | |
| **Prep Method** | Prep Date | 13:00 | | 09/17/22 03:34 | | | | 09/17/22 03:49 | | | | |
| PFAS Top Assay QSM B15 (Post) | Analysis Date | 09/17/22 03:19 | | Water | | | | Water | | | | |
| | Matrix | Water | | | | | | | | | | |

| **PFAS Top Assay QSM B15 (Post)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 120226-60-0 | 8.75U | 8.75 | 193 | 203 | 105 | 70 - 130 | 193 | 223 | 116 | 10 | 20 |
| 11Cl-PF3OUdS | 763051-92-9 | 5.00U | 5.00 | 189 | 196 | 104 | 70 - 130 | 189 | 206 | 109 | 5 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 7.50U | 7.50 | 187 | 197 | 105 | 70 - 130 | 187 | 216 | 115 | 9 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 7.50U | 7.50 | 190 | 194 | 102 | 70 - 130 | 190 | 200 | 105 | 3 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 7.50U | 7.50 | 192 | 207 | 108 | 70 - 130 | 192 | 228 | 119 | 10 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 5.00U | 5.00 | 187 | 200 | 107 | 70 - 130 | 187 | 212 | 114 | 6 | 20 |
| ADONA | 919005-14-4 | 5.00U | 5.00 | 189 | 186 | 99 | 70 - 130 | 189 | 199 | 105 | 6 | 20 |
| NEtFOSA | 4151-50-2 | 10.0U | 10.0 | 200 | 244 | 122 | 70 - 130 | 200 | 241 | 121 | 1 | 20 |
| NEtFOSAA | 2991-50-6 | 10.0U | 10.0 | 200 | 206 | 103 | 70 - 130 | 200 | 216 | 108 | 5 | 20 |
| NEtFOSE | 1691-99-2 | 10.0U | 10.0 | 200 | 221 | 111 | 70 - 130 | 200 | 223 | 111 | 1 | 20 |
| NMeFOSA | 31506-32-8 | 10.0U | 10.0 | 200 | 246 | 123 | 70 - 130 | 200 | 278 | **139*** | 12 | 20 |
| NMeFOSAA | 2355-31-9 | 10.0U | 10.0 | 200 | 209 | 105 | 70 - 130 | 200 | 218 | 109 | 4 | 20 |
| NMeFOSE | 24448-09-7 | 10.0U | 10.0 | 200 | 211 | 105 | 70 - 130 | 200 | 224 | 112 | 6 | 20 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 8.75U | 8.75 | 200 | 200 | 100 | 70 - 130 | 200 | 215 | 108 | 7 | 20 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 8.75U | 8.75 | 178 | 182 | 102 | 70 - 130 | 178 | 189 | 106 | 4 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 37.5U | 37.5 | 400 | 414 | 104 | 70 - 130 | 400 | 429 | 107 | 4 | 20 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 7.50U | 7.50 | 200 | 199 | 99 | 70 - 130 | 200 | 210 | 105 | 6 | 20 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 8.75U | 8.75 | 200 | 203 | 102 | 70 - 130 | 200 | 215 | 108 | 6 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 5.00U | 5.00 | 177 | 182 | 103 | 70 - 130 | 177 | 194 | 109 | 6 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 8.75U | 8.75 | 200 | 202 | 101 | 70 - 130 | 200 | 217 | 109 | 7 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 7.50U | 7.50 | 193 | 204 | 106 | 70 - 130 | 193 | 212 | 110 | 4 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 7.50U | 7.50 | 200 | 200 | 100 | 70 - 130 | 200 | 216 | 108 | 8 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 7.50U | 7.50 | 200 | 203 | 101 | 70 - 130 | 200 | 214 | 107 | 5 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 7.50U | 7.50 | 191 | 195 | 103 | 70 - 130 | 191 | 201 | 105 | 3 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 7.50U | 7.50 | 200 | 199 | 100 | 70 - 130 | 200 | 214 | 107 | 7 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 7.50U | 7.50 | 183 | 184 | 101 | 70 - 130 | 183 | 192 | 105 | 4 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 5.00U | 5.00 | 200 | 203 | 101 | 70 - 130 | 200 | 218 | 109 | 7 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 8.75U | 8.75 | 192 | 203 | 106 | 70 - 130 | 192 | 212 | 110 | 4 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 5.00U | 5.00 | 200 | 199 | 99 | 70 - 130 | 200 | 213 | 107 | 7 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 5.00U | 5.00 | 200 | 212 | 106 | 70 - 130 | 200 | 222 | 111 | 5 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 5.00U | 5.00 | 186 | 187 | 101 | 70 - 130 | 186 | 199 | 107 | 6 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 5.00U | 5.00 | 200 | 198 | 99 | 70 - 130 | 200 | 211 | 105 | 6 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 7.50U | 7.50 | 188 | 194 | 103 | 70 - 130 | 188 | 209 | 111 | 7 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 5.00U | 5.00 | 200 | 202 | 101 | 70 - 130 | 200 | 216 | 108 | 7 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 7.50U | 7.50 | 200 | 201 | 100 | 70 - 130 | 200 | 220 | 110 | 9 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 7.50U | 7.50 | 200 | 205 | 102 | 70 - 130 | 200 | 204 | 102 | 0 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 7.50U | 7.50 | 200 | 203 | 101 | 70 - 130 | 200 | 219 | 109 | 8 | 20 |
| PFDoS | 79780-39-5 | 7.50U | 7.50 | 194 | 202 | 104 | 70 - 130 | 194 | 194 | 100 | 4 | 20 |
| PFHxDA | 67905-19-5 | 8.75U | 8.75 | 200 | 205 | 102 | 70 - 130 | 200 | 222 | 111 | 8 | 20 |
| PFODA | 16517-11-6 | 7.50U | 7.50 | 200 | 133 | **66*** | 70 - 130 | 200 | 8.49 | **4*** | **176*** | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 292 | 117 | 250 | 311 | 124 | 50 - 150 | 250 | 282 | 113 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 305 | 122 | 250 | 317 | 127 | 50 - 150 | 250 | 287 | 115 | NA | NA |
| d7-NMeFOSE | 24448-09-7-EIS | 161 | 64 | 250 | 217 | 87 | 50 - 150 | 250 | 220 | 88 | NA | NA |
| d9-NEtFOSE | 1691-99-2-EIS | 167 | 67 | 250 | 214 | 86 | 50 - 150 | 250 | 215 | 86 | NA | NA |
| d-NEtFOSA | 4151-50-2-EIS | 67.9 | **27*** | 250 | 131 | 52 | 50 - 150 | 250 | 90.1 | **36*** | NA | NA |
| d-NMeFOSA | 31506-32-8-EIS | 70 | **28*** | 250 | 135 | 54 | 50 - 150 | 250 | 97.3 | **39*** | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 316 | 126 | 250 | 321 | 128 | 50 - 150 | 250 | 320 | 128 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 349 | 140 | 250 | 367 | 147 | 50 - 150 | 250 | 330 | 132 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 348 | 139 | 250 | 359 | 144 | 50 - 150 | 250 | 306 | 123 | NA | NA |
| M2PFHxDA | 67905-19-5-EIS | 298 | 119 | 250 | 372 | 149 | 50 - 150 | 250 | 41.3 | **17*** | NA | NA |
| M2PFTA | 376-06-7-EIS | 289 | 116 | 250 | 314 | 126 | 50 - 150 | 250 | 216 | 87 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 320 | 128 | 250 | 333 | 133 | 50 - 150 | 250 | 316 | 127 | NA | NA |
| M3PFBS | 375-73-5-EIS | 308 | 123 | 250 | 322 | 129 | 50 - 150 | 250 | 300 | 120 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 313 | 125 | 250 | 325 | 130 | 50 - 150 | 250 | 309 | 123 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 319 | 128 | 250 | 339 | 136 | 50 - 150 | 250 | 313 | 125 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 315 | 126 | 250 | 333 | 133 | 50 - 150 | 250 | 308 | 123 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 316 | 126 | 250 | 333 | 133 | 50 - 150 | 250 | 311 | 124 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB749316 | LCS749316 | LCSD749316 |
|---|---|---|---|---|
| 750001 | Lab ID | 2393264 | 2393265 | 2393266 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 749316 | Prep Date | 09/12/22 13:00 | 09/12/22 13:00 | 09/12/22 13:00 |
| **Prep Method** | Analysis Date | 09/17/22 03:19 | 09/17/22 03:34 | 09/17/22 03:49 |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Post)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M6PFDA | 335-76-2-EIS | 326 | 130 | 250 | 345 | 138 | 50 - 150 | 250 | 308 | 123 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 308 | 123 | 250 | 330 | 132 | 50 - 150 | 250 | 298 | 119 | NA | NA |
| M8FOSA | 754-91-6-EIS | 263 | 105 | 250 | 276 | 110 | 50 - 150 | 250 | 255 | 102 | NA | NA |
| M8PFOA | 335-67-1-EIS | 320 | 128 | 250 | 340 | 136 | 50 - 150 | 250 | 314 | 125 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 296 | 119 | 250 | 314 | 125 | 50 - 150 | 250 | 287 | 115 | NA | NA |
| M9PFNA | 375-95-1-EIS | 311 | 124 | 250 | 328 | 131 | 50 - 150 | 250 | 298 | 119 | NA | NA |
| MPFBA | 375-22-4-EIS | 317 | 127 | 250 | 336 | 134 | 50 - 150 | 250 | 309 | 124 | NA | NA |
| MPFDoA | 307-55-1-EIS | 309 | 124 | 250 | 318 | 127 | 50 - 150 | 250 | 294 | 118 | NA | NA |
| MPFOA | 335-67-1-SUR | 711 | 142 | 500 | 701 | 140 | 50 - 150 | 500 | 672 | 134 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | | MB751390 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 751501 | Client ID | 2405471 | | LCS751390 | | | | LCSD751390 | | | | |
| **Prep Batch** | Lab ID | MB | | 2405472 | | | | 2405473 | | | | |
| 751390 | Sample Type | 10/07/22 | | LCS | | | | LCSD | | | | |
| **Prep Method** | Prep Date | 11:45 | | 10/07/22 11:45 | | | | 10/07/22 11:45 | | | | |
| PFAS Top Assay QSM B15 (Post) | Analysis Date | 10/10/22 | | 10/10/22 12:52 | | | | 10/10/22 13:07 | | | | |
| | Matrix | 12:37 | | Water | | | | Water | | | | |
| | | Water | | | | | | | | | | |

| **PFAS Top Assay QSM B15 (Post)** | | Units | ng/L | Spike | | | Control | Spike | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Result | LOD | Added | Result | %R | Limits%R | Added | Result | %R | RPD | RPD Limit |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 120226-60-0 | 8.75U | 8.75 | 193 | 223 | 116 | 70 - 130 | 193 | 213 | 110 | 5 | 20 |
| 11Cl-PF3OUdS | 763051-92-9 | 5.00U | 5.00 | 189 | 205 | 109 | 70 - 130 | 189 | 203 | 108 | 1 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 7.50U | 7.50 | 187 | 208 | 111 | 70 - 130 | 187 | 198 | 106 | 5 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 7.50U | 7.50 | 190 | 206 | 108 | 70 - 130 | 190 | 209 | 110 | 1 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 7.50U | 7.50 | 192 | 215 | 112 | 70 - 130 | 192 | 209 | 109 | 3 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 5.00U | 5.00 | 187 | 204 | 110 | 70 - 130 | 187 | 196 | 105 | 4 | 20 |
| ADONA | 919005-14-4 | 5.00U | 5.00 | 189 | 207 | 110 | 70 - 130 | 189 | 195 | 103 | 6 | 20 |
| NEtFOSA | 4151-50-2 | 10.0U | 10.0 | 200 | 233 | 116 | 70 - 130 | 200 | 206 | 103 | 12 | 20 |
| NEtFOSAA | 2991-50-6 | 10.0U | 10.0 | 200 | 207 | 103 | 70 - 130 | 200 | 196 | 98 | 5 | 20 |
| NEtFOSE | 1691-99-2 | 10.0U | 10.0 | 200 | 223 | 112 | 70 - 130 | 200 | 219 | 109 | 2 | 20 |
| NMeFOSA | 31506-32-8 | 10.0U | 10.0 | 200 | 237 | 119 | 70 - 130 | 200 | 220 | 110 | 7 | 20 |
| NMeFOSAA | 2355-31-9 | 10.0U | 10.0 | 200 | 225 | 113 | 70 - 130 | 200 | 212 | 106 | 6 | 20 |
| NMeFOSE | 24448-09-7 | 10.0U | 10.0 | 200 | 216 | 108 | 70 - 130 | 200 | 214 | 107 | 1 | 20 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 8.75U | 8.75 | 200 | 221 | 111 | 70 - 130 | 200 | 209 | 104 | 6 | 20 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 8.75U | 8.75 | 178 | 194 | 109 | 70 - 130 | 178 | 186 | 105 | 4 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 10.0U | 10.0 | 400 | 437 | 109 | 70 - 130 | 400 | 445 | 111 | 2 | 20 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 7.50U | 7.50 | 200 | 219 | 110 | 70 - 130 | 200 | 214 | 107 | 3 | 20 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 8.75U | 8.75 | 200 | 212 | 106 | 70 - 130 | 200 | 206 | 103 | 3 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 5.00U | 5.00 | 177 | 195 | 110 | 70 - 130 | 177 | 191 | 107 | 2 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 8.75U | 8.75 | 200 | 221 | 110 | 70 - 130 | 200 | 216 | 108 | 2 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 7.50U | 7.50 | 193 | 216 | 112 | 70 - 130 | 193 | 206 | 107 | 5 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 7.50U | 7.50 | 200 | 219 | 109 | 70 - 130 | 200 | 216 | 108 | 1 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 7.50U | 7.50 | 200 | 219 | 109 | 70 - 130 | 200 | 211 | 106 | 3 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 7.50U | 7.50 | 191 | 211 | 111 | 70 - 130 | 191 | 205 | 108 | 3 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 7.50U | 7.50 | 200 | 217 | 108 | 70 - 130 | 200 | 211 | 105 | 3 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 7.50U | 7.50 | 183 | 201 | 110 | 70 - 130 | 183 | 195 | 107 | 3 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 5.00U | 5.00 | 200 | 219 | 110 | 70 - 130 | 200 | 214 | 107 | 2 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 8.75U | 8.75 | 192 | 208 | 108 | 70 - 130 | 192 | 207 | 108 | 1 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 5.00U | 5.00 | 200 | 219 | 109 | 70 - 130 | 200 | 210 | 105 | 4 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 5.00U | 5.00 | 200 | 229 | 115 | 70 - 130 | 200 | 219 | 110 | 4 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 5.00U | 5.00 | 186 | 208 | 112 | 70 - 130 | 186 | 194 | 104 | 7 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 5.00U | 5.00 | 200 | 220 | 110 | 70 - 130 | 200 | 209 | 104 | 5 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 7.50U | 7.50 | 188 | 212 | 113 | 70 - 130 | 188 | 205 | 109 | 3 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 5.00U | 5.00 | 200 | 221 | 110 | 70 - 130 | 200 | 216 | 108 | 2 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 7.50U | 7.50 | 200 | 218 | 109 | 70 - 130 | 200 | 216 | 108 | 1 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 7.50U | 7.50 | 200 | 216 | 108 | 70 - 130 | 200 | 220 | 110 | 2 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 7.50U | 7.50 | 200 | 215 | 107 | 70 - 130 | 200 | 209 | 105 | 3 | 20 |
| PFDoS | 79780-39-5 | 7.50U | 7.50 | 194 | 202 | 104 | 70 - 130 | 194 | 206 | 106 | 2 | 20 |
| PFHxDA | 67905-19-5 | 8.75U | 8.75 | 200 | 222 | 111 | 70 - 130 | 200 | 234 | 117 | 5 | 20 |
| PFODA | 16517-11-6 | 7.50U | 7.50 | 200 | 187 | 93 | 70 - 130 | 200 | 208 | 104 | 11 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 217 | 87 | 250 | 225 | 90 | 50 - 150 | 250 | 231 | 92 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 247 | 99 | 250 | 253 | 101 | 50 - 150 | 250 | 256 | 102 | NA | NA |
| d7-NMeFOSE | 24448-09-7-EIS | 169 | 68 | 250 | 179 | 71 | 50 - 150 | 250 | 169 | 68 | NA | NA |
| d9-NEtFOSE | 1691-99-2-EIS | 168 | 67 | 250 | 173 | 69 | 50 - 150 | 250 | 169 | 68 | NA | NA |
| d-NEtFOSA | 4151-50-2-EIS | 151 | 60 | 250 | 160 | 64 | 50 - 150 | 250 | 162 | 65 | NA | NA |
| d-NMeFOSA | 31506-32-8-EIS | 146 | 58 | 250 | 158 | 63 | 50 - 150 | 250 | 153 | 61 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 225 | 90 | 250 | 223 | 89 | 50 - 150 | 250 | 235 | 94 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 206 | 83 | 250 | 207 | 83 | 50 - 150 | 250 | 222 | 89 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 236 | 95 | 250 | 223 | 89 | 50 - 150 | 250 | 248 | 99 | NA | NA |
| M2PFHxDA | 67905-19-5-EIS | 232 | 93 | 250 | 239 | 95 | 50 - 150 | 250 | 261 | 104 | NA | NA |
| M2PFTA | 376-06-7-EIS | 201 | 80 | 250 | 208 | 83 | 50 - 150 | 250 | 228 | 91 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 243 | 97 | 250 | 275 | 110 | 50 - 150 | 250 | 249 | 100 | NA | NA |
| M3PFBS | 375-73-5-EIS | 208 | 83 | 250 | 218 | 87 | 50 - 150 | 250 | 221 | 88 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 212 | 85 | 250 | 222 | 89 | 50 - 150 | 250 | 230 | 92 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 219 | 88 | 250 | 229 | 92 | 50 - 150 | 250 | 219 | 88 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 215 | 86 | 250 | 230 | 92 | 50 - 150 | 250 | 216 | 86 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 210 | 84 | 250 | 223 | 89 | 50 - 150 | 250 | 211 | 84 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB751390 | LCS751390 | LCSD751390 |
|---|---|---|---|---|
| 751501 | Lab ID | 2405471 | 2405472 | 2405473 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 751390 | Prep Date | 10/07/22 11:45 | 10/07/22 11:45 | 10/07/22 11:45 |
| **Prep Method** | Analysis Date | 10/10/22 12:37 | 10/10/22 12:52 | 10/10/22 13:07 |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Post)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M6PFDA | 335-76-2-EIS | 227 | 91 | 250 | 230 | 92 | 50 - 150 | 250 | 223 | 89 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 224 | 90 | 250 | 233 | 93 | 50 - 150 | 250 | 232 | 93 | NA | NA |
| M8FOSA | 754-91-6-EIS | 199 | 80 | 250 | 205 | 82 | 50 - 150 | 250 | 197 | 79 | NA | NA |
| M8PFOA | 335-67-1-EIS | 220 | 88 | 250 | 228 | 91 | 50 - 150 | 250 | 224 | 90 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 214 | 85 | 250 | 222 | 89 | 50 - 150 | 250 | 237 | 95 | NA | NA |
| M9PFNA | 375-95-1-EIS | 223 | 89 | 250 | 227 | 91 | 50 - 150 | 250 | 222 | 89 | NA | NA |
| MPFBA | 375-22-4-EIS | 207 | 83 | 250 | 222 | 89 | 50 - 150 | 250 | 208 | 83 | NA | NA |
| MPFDoA | 307-55-1-EIS | 214 | 85 | 250 | 219 | 88 | 50 - 150 | 250 | 232 | 93 | NA | NA |
| MPFOA | 335-67-1-SUR | 448 | 90 | 500 | 463 | 93 | 50 - 150 | 500 | 434 | 87 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | | MB749157 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 749762 | Client ID | 2392479 | | LCS749157 | | | | LCSD749157 | | | | |
| **Prep Batch** | Lab ID | MB | | 2392480 | | | | 2392481 | | | | |
| 749157 | Sample Type | 09/07/22 | | LCS | | | | LCSD | | | | |
| **Prep Method** | Prep Date | 19:56 | | 09/07/22 19:56 | | | | 09/07/22 19:56 | | | | |
| PFAS Top Assay QSM B15 (Pre) | Analysis Date | 09/15/22 | | 09/15/22 08:14 | | | | 09/15/22 08:29 | | | | |
| | Matrix | 07:59 | | Water | | | | Water | | | | |
| | | Water | | | | | | | | | | |

| **PFAS Top Assay QSM B15 (Pre)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 120226-60-0 | 8.75U | 8.75 | 193 | 207 | 107 | 70 - 130 | 193 | 192 | 99 | 8 | 20 |
| 11Cl-PF3OUdS | 763051-92-9 | 5.00U | 5.00 | 189 | 187 | 99 | 70 - 130 | 189 | 200 | 106 | 6 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 7.50U | 7.50 | 187 | 204 | 109 | 70 - 130 | 187 | 211 | 113 | 3 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 7.50U | 7.50 | 190 | 215 | 113 | 70 - 130 | 190 | 223 | 117 | 4 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 7.50U | 7.50 | 192 | 227 | 118 | 70 - 130 | 192 | 212 | 111 | 7 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 5.00U | 5.00 | 187 | 187 | 100 | 70 - 130 | 187 | 196 | 105 | 5 | 20 |
| ADONA | 919005-14-4 | 5.00U | 5.00 | 189 | 193 | 102 | 70 - 130 | 189 | 205 | 108 | 6 | 20 |
| NEtFOSA | 4151-50-2 | 10.0U | 10.0 | 200 | 219 | 109 | 70 - 130 | 200 | 242 | 121 | 10 | 20 |
| NEtFOSAA | 2991-50-6 | 10.0U | 10.0 | 200 | 202 | 101 | 70 - 130 | 200 | 214 | 107 | 6 | 20 |
| NEtFOSE | 1691-99-2 | 10.0U | 10.0 | 200 | 199 | 99 | 70 - 130 | 200 | 246 | 123 | **21*** | 20 |
| NMeFOSA | 31506-32-8 | 10.0U | 10.0 | 200 | 228 | 114 | 70 - 130 | 200 | 252 | 126 | 10 | 20 |
| NMeFOSAA | 2355-31-9 | 10.0U | 10.0 | 200 | 201 | 101 | 70 - 130 | 200 | 216 | 108 | 7 | 20 |
| NMeFOSE | 24448-09-7 | 10.0U | 10.0 | 200 | 212 | 106 | 70 - 130 | 200 | 209 | 104 | 2 | 20 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 8.75U | 8.75 | 200 | 208 | 104 | 70 - 130 | 200 | 214 | 107 | 3 | 20 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 8.75U | 8.75 | 178 | 185 | 104 | 70 - 130 | 178 | 193 | 109 | 4 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 37.5U | 37.5 | 400 | 411 | 103 | 70 - 130 | 400 | 432 | 108 | 5 | 20 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 7.50U | 7.50 | 200 | 197 | 99 | 70 - 130 | 200 | 205 | 103 | 4 | 20 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 8.75U | 8.75 | 200 | 197 | 98 | 70 - 130 | 200 | 202 | 101 | 3 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 5.00U | 5.00 | 177 | 184 | 104 | 70 - 130 | 177 | 192 | 108 | 4 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 8.75U | 8.75 | 200 | 204 | 102 | 70 - 130 | 200 | 215 | 108 | 6 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 7.50U | 7.50 | 193 | 195 | 101 | 70 - 130 | 193 | 204 | 106 | 4 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 7.50U | 7.50 | 200 | 206 | 103 | 70 - 130 | 200 | 216 | 108 | 5 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 7.50U | 7.50 | 200 | 203 | 102 | 70 - 130 | 200 | 219 | 109 | 7 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 7.50U | 7.50 | 191 | 195 | 102 | 70 - 130 | 191 | 203 | 106 | 4 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 7.50U | 7.50 | 200 | 204 | 102 | 70 - 130 | 200 | 213 | 107 | 4 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 7.50U | 7.50 | 183 | 187 | 102 | 70 - 130 | 183 | 194 | 106 | 4 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 5.00U | 5.00 | 200 | 204 | 102 | 70 - 130 | 200 | 209 | 104 | 2 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 8.75U | 8.75 | 192 | 193 | 100 | 70 - 130 | 192 | 206 | 107 | 7 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 5.00U | 5.00 | 200 | 202 | 101 | 70 - 130 | 200 | 211 | 106 | 5 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 5.00U | 5.00 | 200 | 213 | 106 | 70 - 130 | 200 | 223 | 111 | 4 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 5.00U | 5.00 | 186 | 189 | 102 | 70 - 130 | 186 | 194 | 104 | 2 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 5.00U | 5.00 | 200 | 201 | 101 | 70 - 130 | 200 | 209 | 105 | 4 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 7.50U | 7.50 | 188 | 193 | 102 | 70 - 130 | 188 | 207 | 110 | 7 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 5.00U | 5.00 | 200 | 202 | 101 | 70 - 130 | 200 | 213 | 107 | 5 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 7.50U | 7.50 | 200 | 213 | 107 | 70 - 130 | 200 | 220 | 110 | 3 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 7.50U | 7.50 | 200 | 220 | 110 | 70 - 130 | 200 | 230 | 115 | 4 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 7.50U | 7.50 | 200 | 200 | 100 | 70 - 130 | 200 | 211 | 105 | 5 | 20 |
| PFDoS | 79780-39-5 | 7.50U | 7.50 | 194 | 195 | 101 | 70 - 130 | 194 | 211 | 109 | 8 | 20 |
| PFHxDA | 67905-19-5 | 8.75U | 8.75 | 200 | 206 | 103 | 70 - 130 | 200 | 210 | 105 | 2 | 20 |
| PFODA | 16517-11-6 | 7.50U | 7.50 | 200 | 189 | 94 | 70 - 130 | 200 | 181 | 90 | 4 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 294 | 117 | 250 | 287 | 115 | 50 - 150 | 250 | 280 | 112 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 310 | 124 | 250 | 295 | 118 | 50 - 150 | 250 | 294 | 118 | NA | NA |
| d7-NMeFOSE | 24448-09-7-EIS | 252 | 101 | 250 | 243 | 97 | 50 - 150 | 250 | 245 | 98 | NA | NA |
| d9-NEtFOSE | 1691-99-2-EIS | 239 | 96 | 250 | 247 | 99 | 50 - 150 | 250 | 213 | 85 | NA | NA |
| d-NEtFOSA | 4151-50-2-EIS | 225 | 90 | 250 | 221 | 89 | 50 - 150 | 250 | 150 | 60 | NA | NA |
| d-NMeFOSA | 31506-32-8-EIS | 234 | 94 | 250 | 209 | 84 | 50 - 150 | 250 | 160 | 64 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 289 | 116 | 250 | 282 | 113 | 50 - 150 | 250 | 267 | 107 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 307 | 123 | 250 | 277 | 111 | 50 - 150 | 250 | 263 | 105 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 332 | 133 | 250 | 269 | 108 | 50 - 150 | 250 | 296 | 119 | NA | NA |
| M2PFHxDA | 67905-19-5-EIS | 331 | 133 | 250 | 306 | 122 | 50 - 150 | 250 | 288 | 115 | NA | NA |
| M2PFTA | 376-06-7-EIS | 293 | 117 | 250 | 280 | 112 | 50 - 150 | 250 | 275 | 110 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 274 | 110 | 250 | 281 | 112 | 50 - 150 | 250 | 274 | 110 | NA | NA |
| M3PFBS | 375-73-5-EIS | 289 | 116 | 250 | 279 | 111 | 50 - 150 | 250 | 265 | 106 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 290 | 116 | 250 | 276 | 110 | 50 - 150 | 250 | 271 | 108 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 276 | 110 | 250 | 272 | 109 | 50 - 150 | 250 | 267 | 107 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 285 | 114 | 250 | 279 | 111 | 50 - 150 | 250 | 275 | 110 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 280 | 112 | 250 | 279 | 112 | 50 - 150 | 250 | 270 | 108 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB749157 | LCS749157 | LCSD749157 |
|---|---|---|---|---|
| 749762 | Lab ID | 2392479 | 2392480 | 2392481 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 749157 | Prep Date | 09/07/22 19:56 | 09/07/22 19:56 | 09/07/22 19:56 |
| **Prep Method** | Analysis Date | 09/15/22 07:59 | 09/15/22 08:14 | 09/15/22 08:29 |
| PFAS Top Assay QSM B15 (Pre) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Pre)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M6PFDA | 335-76-2-EIS | 295 | 118 | 250 | 274 | 110 | 50 - 150 | 250 | 272 | 109 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 300 | 120 | 250 | 290 | 116 | 50 - 150 | 250 | 286 | 115 | NA | NA |
| M8FOSA | 754-91-6-EIS | 252 | 101 | 250 | 238 | 95 | 50 - 150 | 250 | 237 | 95 | NA | NA |
| M8PFOA | 335-67-1-EIS | 283 | 113 | 250 | 277 | 111 | 50 - 150 | 250 | 270 | 108 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 291 | 117 | 250 | 281 | 112 | 50 - 150 | 250 | 274 | 109 | NA | NA |
| M9PFNA | 375-95-1-EIS | 292 | 117 | 250 | 284 | 114 | 50 - 150 | 250 | 273 | 109 | NA | NA |
| MPFBA | 375-22-4-EIS | 282 | 113 | 250 | 280 | 112 | 50 - 150 | 250 | 266 | 106 | NA | NA |
| MPFDoA | 307-55-1-EIS | 282 | 113 | 250 | 265 | 106 | 50 - 150 | 250 | 263 | 105 | NA | NA |
| MPFOA | 335-67-1-SUR | 601 | 120 | 500 | 605 | 121 | 50 - 150 | 500 | 595 | 119 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | | MB750661 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 751527 | Client ID | 2400713 | | LCS750661 | | | | LCSD750661 | | | | |
| **Prep Batch** | Lab ID | MB | | 2400714 | | | | 2400715 | | | | |
| 750661 | Sample Type | 10/08/22 | | LCS | | | | LCSD | | | | |
| **Prep Method** | Prep Date | 09:00 | | 10/08/22 09:00 | | | | 10/08/22 09:00 | | | | |
| PFAS Top Assay QSM B15 (Pre) | Analysis Date | 10/10/22 | | 10/11/22 00:02 | | | | 10/11/22 00:17 | | | | |
| | Matrix | 23:48 | | Water | | | | Water | | | | |
| **PFAS Top Assay QSM B15 (Pre)** | | Units | ng/L | Spike | Result | %R | Control | Spike | Result | %R | RPD | RPD |
| | | Result | LOD | Added | | | Limits%R | Added | | | | Limit |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 120226-60-0 | 8.75U | 8.75 | 193 | 191 | 99 | 70 - 130 | 193 | 193 | 100 | 1 | 20 |
| 11Cl-PF3OUdS | 763051-92-9 | 5.00U | 5.00 | 189 | 203 | 108 | 70 - 130 | 189 | 199 | 106 | 2 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 7.50U | 7.50 | 187 | 228 | 122 | 70 - 130 | 187 | 204 | 109 | 11 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 7.50U | 7.50 | 190 | 216 | 114 | 70 - 130 | 190 | 211 | 111 | 2 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 7.50U | 7.50 | 192 | 213 | 111 | 70 - 130 | 192 | 212 | 111 | 0 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 5.00U | 5.00 | 187 | 202 | 108 | 70 - 130 | 187 | 194 | 104 | 4 | 20 |
| ADONA | 919005-14-4 | 5.00U | 5.00 | 189 | 206 | 109 | 70 - 130 | 189 | 193 | 102 | 6 | 20 |
| NEtFOSA | 4151-50-2 | 10.0U | 10.0 | 200 | 215 | 107 | 70 - 130 | 200 | 187 | 93 | 14 | 20 |
| NEtFOSAA | 2991-50-6 | 10.0U | 10.0 | 200 | 213 | 107 | 70 - 130 | 200 | 207 | 104 | 3 | 20 |
| NEtFOSE | 1691-99-2 | 10.0U | 10.0 | 200 | 213 | 107 | 70 - 130 | 200 | 201 | 101 | 6 | 20 |
| NMeFOSA | 31506-32-8 | 10.0U | 10.0 | 200 | 220 | 110 | 70 - 130 | 200 | 188 | 94 | 15 | 20 |
| NMeFOSAA | 2355-31-9 | 10.0U | 10.0 | 200 | 231 | 115 | 70 - 130 | 200 | 216 | 108 | 7 | 20 |
| NMeFOSE | 24448-09-7 | 10.0U | 10.0 | 200 | 222 | 111 | 70 - 130 | 200 | 202 | 101 | 10 | 20 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 8.75U | 8.75 | 200 | 207 | 103 | 70 - 130 | 200 | 196 | 98 | 5 | 20 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 8.75U | 8.75 | 178 | 197 | 110 | 70 - 130 | 178 | 186 | 104 | 6 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 10.0U | 10.0 | 400 | 451 | 113 | 70 - 130 | 400 | 436 | 109 | 3 | 20 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 7.50U | 7.50 | 200 | 205 | 102 | 70 - 130 | 200 | 196 | 98 | 5 | 20 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 8.75U | 8.75 | 200 | 210 | 105 | 70 - 130 | 200 | 199 | 100 | 5 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 5.00U | 5.00 | 177 | 193 | 109 | 70 - 130 | 177 | 186 | 105 | 4 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 8.75U | 8.75 | 200 | 217 | 109 | 70 - 130 | 200 | 203 | 102 | 7 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 7.50U | 7.50 | 193 | 205 | 106 | 70 - 130 | 193 | 196 | 102 | 4 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 7.50U | 7.50 | 200 | 214 | 107 | 70 - 130 | 200 | 206 | 103 | 4 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 7.50U | 7.50 | 200 | 220 | 110 | 70 - 130 | 200 | 209 | 105 | 5 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 7.50U | 7.50 | 191 | 215 | 113 | 70 - 130 | 191 | 200 | 105 | 7 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 7.50U | 7.50 | 200 | 214 | 107 | 70 - 130 | 200 | 206 | 103 | 4 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 7.50U | 7.50 | 183 | 195 | 107 | 70 - 130 | 183 | 187 | 102 | 4 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 5.00U | 5.00 | 200 | 211 | 106 | 70 - 130 | 200 | 199 | 99 | 6 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 8.75U | 8.75 | 192 | 205 | 107 | 70 - 130 | 192 | 193 | 100 | 6 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 5.00U | 5.00 | 200 | 217 | 109 | 70 - 130 | 200 | 206 | 103 | 5 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 5.00U | 5.00 | 200 | 214 | 107 | 70 - 130 | 200 | 208 | 104 | 3 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 5.00U | 5.00 | 186 | 198 | 106 | 70 - 130 | 186 | 188 | 101 | 5 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 5.00U | 5.00 | 200 | 219 | 109 | 70 - 130 | 200 | 206 | 103 | 6 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 7.50U | 7.50 | 188 | 200 | 106 | 70 - 130 | 188 | 193 | 102 | 4 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 5.00U | 5.00 | 200 | 216 | 108 | 70 - 130 | 200 | 206 | 103 | 5 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 7.50U | 7.50 | 200 | 213 | 107 | 70 - 130 | 200 | 204 | 102 | 4 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 7.50U | 7.50 | 200 | 218 | 109 | 70 - 130 | 200 | 199 | 100 | 9 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 7.50U | 7.50 | 200 | 217 | 108 | 70 - 130 | 200 | 204 | 102 | 6 | 20 |
| PFDoS | 79780-39-5 | 7.50U | 7.50 | 194 | 192 | 99 | 70 - 130 | 194 | 199 | 102 | 4 | 20 |
| PFHxDA | 67905-19-5 | 8.75U | 8.75 | 200 | 210 | 105 | 70 - 130 | 200 | 205 | 102 | 3 | 20 |
| PFODA | 16517-11-6 | 7.50U | 7.50 | 200 | 178 | 89 | 70 - 130 | 200 | 201 | 100 | 12 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 257 | 103 | 250 | 245 | 98 | 50 - 150 | 250 | 258 | 103 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 266 | 106 | 250 | 266 | 106 | 50 - 150 | 250 | 274 | 109 | NA | NA |
| d7-NMeFOSE | 24448-09-7-EIS | 188 | 75 | 250 | 192 | 77 | 50 - 150 | 250 | 201 | 80 | NA | NA |
| d9-NEtFOSE | 1691-99-2-EIS | 161 | 64 | 250 | 195 | 78 | 50 - 150 | 250 | 206 | 82 | NA | NA |
| d-NEtFOSA | 4151-50-2-EIS | 103 | **41*** | 250 | 143 | 57 | 50 - 150 | 250 | 155 | 62 | NA | NA |
| d-NMeFOSA | 31506-32-8-EIS | 112 | **45*** | 250 | 144 | 58 | 50 - 150 | 250 | 165 | 66 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 286 | 115 | 250 | 254 | 102 | 50 - 150 | 250 | 277 | 111 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 277 | 111 | 250 | 257 | 103 | 50 - 150 | 250 | 260 | 104 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 277 | 111 | 250 | 275 | 110 | 50 - 150 | 250 | 278 | 111 | NA | NA |
| M2PFHxDA | 67905-19-5-EIS | 261 | 104 | 250 | 266 | 106 | 50 - 150 | 250 | 292 | 117 | NA | NA |
| M2PFTA | 376-06-7-EIS | 241 | 96 | 250 | 232 | 93 | 50 - 150 | 250 | 245 | 98 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 264 | 106 | 250 | 239 | 96 | 50 - 150 | 250 | 252 | 101 | NA | NA |
| M3PFBS | 375-73-5-EIS | 267 | 107 | 250 | 248 | 99 | 50 - 150 | 250 | 254 | 102 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 269 | 107 | 250 | 244 | 98 | 50 - 150 | 250 | 256 | 102 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 276 | 110 | 250 | 259 | 104 | 50 - 150 | 250 | 268 | 107 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 273 | 109 | 250 | 257 | 103 | 50 - 150 | 250 | 266 | 106 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 274 | 110 | 250 | 252 | 101 | 50 - 150 | 250 | 261 | 104 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB750661 | LCS750661 | LCSD750661 |
|---|---|---|---|---|
| 751527 | Lab ID | 2400713 | 2400714 | 2400715 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 750661 | Prep Date | 10/08/22 09:00 | 10/08/22 09:00 | 10/08/22 09:00 |
| **Prep Method** | Analysis Date | 10/10/22 23:48 | 10/11/22 00:02 | 10/11/22 00:17 |
| PFAS Top Assay QSM B15 (Pre) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Pre)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M6PFDA | 335-76-2-EIS | 273 | 109 | 250 | 262 | 105 | 50 - 150 | 250 | 270 | 108 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 267 | 107 | 250 | 264 | 106 | 50 - 150 | 250 | 277 | 111 | NA | NA |
| M8FOSA | 754-91-6-EIS | 212 | 85 | 250 | 217 | 87 | 50 - 150 | 250 | 211 | 85 | NA | NA |
| M8PFOA | 335-67-1-EIS | 277 | 111 | 250 | 256 | 103 | 50 - 150 | 250 | 268 | 107 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 260 | 104 | 250 | 253 | 101 | 50 - 150 | 250 | 260 | 104 | NA | NA |
| M9PFNA | 375-95-1-EIS | 277 | 111 | 250 | 262 | 105 | 50 - 150 | 250 | 271 | 108 | NA | NA |
| MPFBA | 375-22-4-EIS | 265 | 106 | 250 | 243 | 97 | 50 - 150 | 250 | 257 | 103 | NA | NA |
| MPFDoA | 307-55-1-EIS | 261 | 104 | 250 | 248 | 99 | 50 - 150 | 250 | 264 | 105 | NA | NA |
| MPFOA | 335-67-1-SUR | 532 | 106 | 500 | 521 | 104 | 50 - 150 | 500 | 533 | 107 | NA | NA |

# Top Assay Pre/Post Summary

| Client ID | CMT-VRTB-01_2_08252022 | | | | CMT-VRTB-01_3_08252022 | | | |
|---|---|---|---|---|---|---|---|---|
| LAB ID | 22208314101 | | | | 22208314102 | | | |
| Collected | 08/25/22 09:05 | | | | 08/25/22 09:55 | | | |
| Matrix | Water | | | | Water | | | |
| Units | ng/L | | | | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8750U | 8750U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| 11Cl-PF3OUdS | 5000U | 5000U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7500U | 7500U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7500U | 7500U | 0 | 0 | 24.9 | 7.50U | -24.9 | 200 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7500U | 7500U | 0 | 0 | 11.0 | 7.50U | -11 | 200 |
| 9Cl-PF3ONS | 5000U | 5000U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| ADONA | 5000U | 5000U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| NEtFOSA | 10000U | 10000U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NEtFOSAA | 10000U | 10000U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NEtFOSE | 10000U | 10000U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSA | 10000U | 10000U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSAA | 10000U | 10000U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSE | 10000U | 10000U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8750U | 8750U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| PFDoS | 7500U | 7500U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| PFHxDA | 8750U | 8750U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| PFODA | 7500U | 7500U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8750U | 8750U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 37500U | 37500U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 7500U | 7500U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 8750U | 8750U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 5000U | 5000U | 0 | 0 | 10.7 | 8.60J | -2.1 | 21.8 |
| Perfluorobutanoic acid (PFBA) | 8750U | 8750U | 0 | 0 | 12.5 | 60.2 | 47.7 | 131.2 |
| Perfluorodecane sulfonic acid (PFDS) | 7500U | 7500U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 7500U | 7500U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 7500U | 7500U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 7500U | 7500U | 0 | 0 | 21.0 | 17.0 | -4 | 21.1 |
| Perfluoroheptanoic acid (PFHpA) | 7500U | 7500U | 0 | 0 | 25.3 | 29.6 | 4.3 | 15.7 |
| Perfluorohexanesulfonic acid (PFHxS) | 6400J | 6380J | -20 | 0.3 | 453 | 400 | -53 | 12.4 |
| Perfluorohexanoic acid (PFHxA) | 5000U | 11300 | 11300 | 200 | 25.1 | 419 | 393.9 | 177.4 |
| Perfluorononanesulfonic acid (PFNS) | 8750U | 8750U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 5000U | 5000U | 0 | 0 | 17.4 | 13.3 | -4.1 | 26.7 |
| Perfluorooctane Sulfonamide (FOSA) | 5000U | 5000U | 0 | 0 | 5.00U | 2.04J | 2.04 | 200 |
| Perfluorooctanesulfonic acid (PFOS) | 64200 | 57100 | -7100 | 11.7 | 2730 | 2180 | -550 | 22.4 |
| Perfluorooctanoic acid (PFOA) | 5000U | 5000U | 0 | 0 | 61.2 | 54.0 | -7.2 | 12.5 |
| Perfluoropentanesulfonic acid (PFPeS) | 7500U | 7500U | 0 | 0 | 14.0 | 11.4 | -2.6 | 20.5 |
| Perfluoropentanoic acid (PFPeA) | 5000U | 3450J | 3450 | 200 | 19.9 | 98.1 | 78.2 | 132.5 |
| Perfluorotetradecanoic acid (PFTA) | 7500U | 7500U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 7500U | 7500U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 7500U | 7500U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |

Chain of Custody

Pace Analytical
www.pacelabs.com

Workorder: XH26042 Workorder Name: ESTCP Vertebrae Owner Received Date: 8/26/2022 Results Requested By: 9/16/2022

| Report To: | Subcontract To: |
|---|---|
| Kathy E. Smith | Project # |
| Pace Analytical | |
| 106 Vantage Point Drive | Pace - Gulf Coast |
| Columbia SC, 29223 | 7979 Innovation Park Drive |
| 803-227-2704 | Baton Rouge, LA 70820 |
| Kathy.Smith@pacelabs.com | |

| Item | Sample ID | Sample Type | Collect Date/Time | Lab ID | Matrix | Preserved Containers | TOP Assay | Requested Analysis | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CMT-VRTB-01_2_0825202 | grab | 08/25/2022 @ 0905 | XH26042-010 | Aqueous | | x | | 1 |
| 2 | CMT-VRTB-01_3_0825202 | grab | 08/25/2022 @ 0955 | XH26042-011 | Aqueous | | x | | 2 |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |

| Transfers | Released By | Date/Time | Reveived By | Date/Time | Comments |
|---|---|---|---|---|---|
| 1 | | | | | 0.3446 |
| 2 | | | | | 1663 3467 7950 |
| 3 | FedEx | 8/30/22 1800 | | | |
| | | 8/31/22 9:27 | | 8/31/22 9:27 | |

| Cooler Temperature on Receipt _____ °C | Custody Seal Y or N | Received on Ice Y or N | Sample Intact Y or N |
|---|---|---|---|

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Friday, June 17, 2016 11:01:34 AM FMT-ALL-C-002rev.(

Client ID: 4367 - Pace Analytical Services
SDG: 222083141
PM: RWe

# SAMPLE RECEIVING CHECKLIST

| SAMPLE DELIVERY GROUP 222083141 | |
|---|---|
| **Client** **PM** RWe<br>4367 - Pace Analytical Services | **Transport Method**<br>FEDEX |
| **Profile Number**<br>294268 | **Received By**<br>Roberts, George S. |
| **Line Item(s)**<br>4 - Top Assay Water | **Receive Date(s)**<br>08/31/22 |

| CHECKLIST | YES | NO |
|---|---|---|
| Samples received with proper thermal preservation? | ☑ | ☐ |
| Radioactivity is <1600 cpm? If no, record cpm value in notes section. | ☑ | ☐ |
| COC relinquished and complete (including sampleIDs, collect times, and sampler)? | ☑ | ☐ |
| All containers received in good condition and within hold time? | ☑ | ☐ |
| All sample labels and containers received match the chain of custody? | ☑ | ☐ |
| Preservative added to any containers? | ☐ | ☑ |
| If received, was headspace for VOC water containers < 6mm? | ☑ | ☐ |
| Samples collected in containers provided by Pace Gulf Coast? | ☑ | ☐ |

**COOLERS**

| Airbill | Thermometer ID: E42 | Temp °C |
|---|---|---|
| 1663 3467 7950 | | 0.3 |

**DISCREPANCIES**

None

**LAB PRESERVATIONS**

None

**NOTES**

Revision 1.6

*LELAP Certificate Number: 01955*
*A2LA Accredited (DoD ELAP-QSM 5.4) Certificate Number: 6429.01*

# ANALYTICAL RESULTS

**PERFORMED BY**

**Pace Analytical Gulf Coast**
**7979 Innovation Park Dr.**
**Baton Rouge, LA 70820**
**(225) 769-4900**

**Report Date** 10/21/2022

**Report #** 222083142

***Project*** XH29054 ESTCP Vertebrae

**Samples Collected** 8/23/22

| ***Deliver To*** | ***Additional Recipients*** |
|---|---|
| Kathy Smith<br>Pace Analytical<br>106 Vantage Point Drive<br>Columbia, SC 29223<br>803-227-2704 | NONE |

A2LA ACCREDITED
CERT # 6429.01

# Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with Pace Gulf Coast's Standard Operating Procedures.

**Common Abbreviations that may be Utilized in this Report**

| | |
|---|---|
| **ND** | Indicates the result was Not Detected at the specified reporting limit |
| **NO** | Indicates the sample did not ignite when preliminary test performed for EPA Method 1030 |
| **DO** | Indicates the result was Diluted Out |
| **MI** | Indicates the result was subject to Matrix Interference |
| **TNTC** | Indicates the result was Too Numerous To Count |
| **SUBC** | Indicates the analysis was Sub-Contracted |
| **FLD** | Indicates the analysis was performed in the Field |
| **DL** | Detection Limit |
| **LOD** | Limit of Detection |
| **LOQ** | Limit of Quantitation |
| **RE** | Re-analysis |
| **CF** | HPLC or GC Confirmation |
| **00:01** | Reported as a time equivalent to 12:00 AM |

**Reporting Flags that may be Utilized in this Report**

| | |
|---|---|
| **J or I** | Indicates the result is between the MDL and LOQ |
| **J** | DOD flag on analyte in the parent sample for MS/MSD outside acceptance criteria |
| **U** | Indicates the compound was analyzed for but not detected |
| **B or V** | Indicates the analyte was detected in the associated Method Blank |
| **Q** | Indicates a non-compliant QC Result (See Q Flag Application Report) |
| ***** | Indicates a non-compliant or not applicable QC recovery or RPD – see narrative |
| **E** | Organics **-** The result is estimated because it exceeded the instrument calibration range |
| **E** | Metals - % diference for the serial dilution is > 10% |
| **L** | Reporting Limits adjusted to meet risk-based limit. |
| **P** | RPD between primary and confirmation result is greater than 40 |
| **DL** | Diluted analysis – when appended to Client Sample ID |

Sample receipt at Pace Gulf Coast is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of Pace Gulf Coast. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with The NELAC Institute (TNI) Standard 2009 and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.



Authorized Signature
Pace Gulf Coast Report 222083142

# Certifications

| Certification | Certification Number |
|---|---|
| A2LA Accredited (DoD ELAP-QSM 5.4) | 6429.01 |
| Alabama | 01955 |
| Arkansas | 88-0655 |
| Colorado | 01955 |
| Delaware | 01955 |
| Florida | E87854 |
| Georgia | 01955 |
| Hawaii | 01955 |
| Idaho | 01955 |
| Illinois | 200048 |
| Indiana | 01955 |
| Kansas | E-10354 |
| Kentucky | 95 |
| Louisiana | 01955 |
| Maryland | 01955 |
| Massachusetts | 01955 |
| Michigan | 01955 |
| Mississippi | 01955 |
| Missouri | 01955 |
| Montana | N/A |
| Nebraska | 01955 |
| New Mexico | 01955 |
| North Carolina | 618 |
| North Dakota | R-195 |
| Oklahoma | 9403 |
| South Carolina | 73006001 |
| South Dakota | 01955 |
| Tennessee | 01955 |
| Texas | T104704178 |
| Vermont | 01955 |
| Virginia | 460215 |
| Washington | C929 |
| USDA Soil Permit | P330-16-00234 |

# Case Narrative

**Client:** Pace Analytical Services **Report:** 222083142

Pace Analytical Gulf Coast received and analyzed the sample(s) listed
on the Report Sample Summary page of this report. Receipt of the sample(s) is documented
by the attached chain of custody. This applies only to the sample(s) listed in this report.
No sample integrity or quality control exceptions were identified unless noted below.

This report was completed in accordance with DOD QSM 5.3 as specified in the contract.

**SEMI-VOLATILES MASS SPECTROMETRY**

Samples 22208314201 (VRTB-L-B1_08232022), 22208314202 (VRTB-L-S2_08232022), 22208314203 (VRTB-L-Y3_08232022), 22208314204 (VRTB-L-G4_08232022), 22208314205 (VRTB-L-M5_08232022), 22208314206 (VRTB-L-06_08232022), 22208314207 (VRTB-L-P7_08232022) and 22208314208 (VRTB-L-BB8_08232022) were re-extracted outside holding time due to the original extract being unnecessarily diluted 1:1000

In the PFAS Top Assay QSM B15 (Pre) analysis, the recovery for the extracted internal standard d-NEtFOSA, d-NMeFOSA and M2PFHxDA is outside the control limits for sample 22208314208 (VRTB-L-BB8_08232022) .

In the PFAS Top Assay QSM B15 (Pre) analysis, the recovery for the extracted internal standard d-NEtFOSA and d-NMeFOSA is outside the control limits for sample 2400713 (MB for HBN 750661 [LCMS/6658]) .

In the PFAS Top Assay QSM B15 (Pre) analysis, the recovery for the extracted internal standard d-NEtFOSA, d-NMeFOSA, d7-NMeFOSE and d9-NEtFOSE is outside the control limits for sample 22208314202 (VRTB-L-S2_08232022) .

In the PFAS Top Assay QSM B15 (Pre) analysis, the recovery for the extracted internal standard d-NEtFOSA and d9-NEtFOSE is outside the control limits for sample 22208314205 (VRTB-L-M5_08232022) .

In the PFAS Top Assay QSM B15 (Pre) analysis, the recovery for the extracted internal standard d-NEtFOSA, d-NMeFOSA, d7-NMeFOSE and d9-NEtFOSE is outside the control limits for sample 22208314207 (VRTB-L-P7_08232022) .

In the PFAS Top Assay QSM B15 (Pre) analysis for prep batch 749157, the LCS/LCSD RPD is above the control limit for NEtFOSE.

# Sample Summary

| Lab ID | Client ID | Matrix | Collect Date | Receive Date |
|---|---|---|---|---|
| 22208314201 | VRTB-L-B1_08232022 | Water | 8/23/22 12:40 | 8/31/22 09:27 |
| 22208314202 | VRTB-L-S2_08232022 | Water | 8/23/22 13:25 | 8/31/22 09:27 |
| 22208314203 | VRTB-L-Y3_08232022 | Water | 8/23/22 14:20 | 8/31/22 09:27 |
| 22208314204 | VRTB-L-G4_08232022 | Water | 8/23/22 15:10 | 8/31/22 09:27 |
| 22208314205 | VRTB-L-M5_08232022 | Water | 8/23/22 16:20 | 8/31/22 09:27 |
| 22208314206 | VRTB-L-06_08232022 | Water | 8/23/22 17:10 | 8/31/22 09:27 |
| 22208314207 | VRTB-L-P7_08232022 | Water | 8/23/22 18:00 | 8/31/22 09:27 |
| 22208314208 | VRTB-L-BB8_08232022 | Water | 8/23/22 18:40 | 8/31/22 09:27 |

# Test Summary

| PFAS Top Assay QSM B15 (Pre) | | | | | |
|---|---|---|---|---|---|
| **Lab ID** | **Client ID** | **Matrix** | **Batch** | **Instru** | **RunDate** |
| 22208314201 | VRTB-L-B1_08232022 | Water | 751527 | QQQ5 | 10/11/22 02:29 |
| 22208314202 | VRTB-L-S2_08232022 | Water | 751527 | QQQ5 | 10/11/22 02:43 |
| 22208314203 | VRTB-L-Y3_08232022 | Water | 751527 | QQQ5 | 10/11/22 03:13 |
| 22208314203DL | VRTB-L-Y3_08232022DL | Water | 752181 | QQQ4 | 10/19/22 06:58 |
| 22208314204 | VRTB-L-G4_08232022 | Water | 751527 | QQQ5 | 10/11/22 03:27 |
| 22208314205 | VRTB-L-M5_08232022 | Water | 751527 | QQQ5 | 10/11/22 03:42 |
| 22208314205DL | VRTB-L-M5_08232022DL | Water | 752181 | QQQ4 | 10/19/22 07:13 |
| 22208314206 | VRTB-L-06_08232022 | Water | 751527 | QQQ5 | 10/11/22 03:57 |
| 22208314206DL | VRTB-L-06_08232022DL | Water | 752181 | QQQ4 | 10/19/22 07:28 |
| 22208314207 | VRTB-L-P7_08232022 | Water | 751527 | QQQ5 | 10/11/22 04:11 |
| 22208314207DL | VRTB-L-P7_08232022DL | Water | 752181 | QQQ4 | 10/19/22 07:43 |
| 22208314208 | VRTB-L-BB8_08232022 | Water | 751527 | QQQ5 | 10/11/22 04:26 |
| 22208314208DL | VRTB-L-BB8_08232022DL | Water | 752181 | QQQ4 | 10/19/22 07:58 |

| PFAS Top Assay QSM B15 (Post) | | | | | |
|---|---|---|---|---|---|
| **Lab ID** | **Client ID** | **Matrix** | **Batch** | **Instru** | **RunDate** |
| 22208314201 | VRTB-L-B1_08232022 | Water | 751501 | QQQ4 | 10/10/22 15:36 |
| 22208314202 | VRTB-L-S2_08232022 | Water | 751501 | QQQ4 | 10/10/22 15:51 |
| 22208314203 | VRTB-L-Y3_08232022 | Water | 751501 | QQQ4 | 10/10/22 16:20 |
| 22208314203DL | VRTB-L-Y3_08232022DL | Water | 752183 | QQQ4 | 10/19/22 12:56 |
| 22208314204 | VRTB-L-G4_08232022 | Water | 751501 | QQQ4 | 10/10/22 16:36 |
| 22208314205 | VRTB-L-M5_08232022 | Water | 751501 | QQQ4 | 10/10/22 16:50 |
| 22208314205DL | VRTB-L-M5_08232022DL | Water | 752183 | QQQ4 | 10/19/22 13:11 |
| 22208314206 | VRTB-L-06_08232022 | Water | 751501 | QQQ4 | 10/10/22 17:05 |
| 22208314206DL | VRTB-L-06_08232022DL | Water | 752183 | QQQ4 | 10/19/22 13:26 |
| 22208314207 | VRTB-L-P7_08232022 | Water | 751501 | QQQ4 | 10/10/22 17:20 |
| 22208314207DL | VRTB-L-P7_08232022DL | Water | 752183 | QQQ4 | 10/19/22 13:41 |
| 22208314208 | VRTB-L-BB8_08232022 | Water | 751501 | QQQ4 | 10/10/22 17:35 |
| 22208314208DL | VRTB-L-BB8_08232022DL | Water | 752183 | QQQ4 | 10/19/22 13:56 |

# Manual Integrations

Manual Integrations for LC and IC (if performed) are documented in the raw data.
No other manual integrations were performed by Pace Gulf Coast.

# Q Flag Summary

NO Q FLAGS FOR THIS WORKORDER

# Detect Summary

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22208314201 | VRTB-L-B1_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 10.6 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 52.5 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 11.7 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 12.4 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 187 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 147 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 5.67J | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 798 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 27.9 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 15.6 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 54.9 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 8.02J | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 96.0 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 18.2 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 39.3 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 333 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 942 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 16.0 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 2590 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 62.7 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 13.2 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 227 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 4.61J | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 95.0 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 35.6 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 87.7 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 570 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 2160 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 47.1 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 9630 | 5 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 158 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 10.0 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 323 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 7.90J | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 120 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 42.2 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 144 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1630 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 1130 | 1 | NA |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22208314204 | VRTB-L-G4_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 20.6 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 2380 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 202 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 28.5 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 275 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 14.2 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 172 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 57.8 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 177 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1470 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 1800 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 52.7 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 9450 | 5 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 215 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 41.9 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 468 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 16.3 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 184 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 80.5 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 230 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1810 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 2470 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 71.2 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 14100 | 5 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 307 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 47.1 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 536 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 11.7 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 183 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 58.7 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 148 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 915 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 1310 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 49.8 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 15100 | 5 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 155 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 25.1 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 405 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 25.5 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 212 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 63.4 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 183 | 1 | NA |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Post)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1810 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 2120 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 44.8 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 9030 | 5 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 186 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 67.4 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 571 | 1 | NA |

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22208314201 | VRTB-L-B1_08232022 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 4.06J | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 9.14J | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 9.03J | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 13.7 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 11.0 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 196 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 19.3 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 6.05J | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 885 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 29.1 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 14.9 | 1 | NA |
| 22208314201 | VRTB-L-B1_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 13.8 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 26.1 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 43.5 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 9.45J | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 11.7 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 21.8 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 21.6 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 382 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 27.2 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 18.7 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 2920 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 65.2 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 16.3 | 1 | NA |
| 22208314202 | VRTB-L-S2_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 16.7 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 63.5 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 113 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 5.60J | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 10.3 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 42.0 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 34.7 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 611 | 1 | NA |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 27.1 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 53.3 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 11200 | 5 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 128 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 10.4 | 1 | NA |
| 22208314203 | VRTB-L-Y3_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 19.6 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 79.7 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 39.4 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 8.47J | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 34.7 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 47.1 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 126 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1800 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 104 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 22.0 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 2520 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 204 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 29.2 | 1 | NA |
| 22208314204 | VRTB-L-G4_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 61.8 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 171 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 44.9 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 15.0 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 46.5 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 75.5 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 141 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1720 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 170 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 68.8 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorooctane Sulfonamide (FOSA) | ng/L | 2.83J | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 13400 | 5 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 231 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 42.5 | 1 | NA |
| 22208314205 | VRTB-L-M5_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 114 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 197 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 40.3 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 18.2 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 71.1 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 89.4 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 181 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1980 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 233 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 82.2 | 1 | NA |

# Detect Summary (Continued)

Results and Detection Limits are adjusted for dilution and moisture when applicable

**PFAS Top Assay QSM B15 (Pre)**

| Lab ID | Client ID | Parameter | Units | Result | Dil. | %Moist |
|---|---|---|---|---|---|---|
| 22208314206 | VRTB-L-06_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 15500 | 5 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 294 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 48.6 | 1 | NA |
| 22208314206 | VRTB-L-06_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 170 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 87.7 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 48.3 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 10.5 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 48.3 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 70.6 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 117 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 928 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 128 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 57.9 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 18700 | 5 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 145 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 21.5 | 1 | NA |
| 22208314207 | VRTB-L-P7_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 122 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | ng/L | 73.6 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ng/L | 20.5 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorobutanesulfonic acid (PFBS) | ng/L | 23.7 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorobutanoic acid (PFBA) | ng/L | 58.9 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluoroheptanesulfonic acid (PFHpS) | ng/L | 68.6 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluoroheptanoic acid (PFHpA) | ng/L | 140 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorohexanesulfonic acid (PFHxS) | ng/L | 1780 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorohexanoic acid (PFHxA) | ng/L | 222 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorononanoic acid (PFNA) | ng/L | 46.4 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorooctanesulfonic acid (PFOS) | ng/L | 9090 | 5 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluorooctanoic acid (PFOA) | ng/L | 175 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluoropentanesulfonic acid (PFPeS) | ng/L | 55.5 | 1 | NA |
| 22208314208 | VRTB-L-BB8_08232022 | Perfluoropentanoic acid (PFPeA) | ng/L | 159 | 1 | NA |

# Sample Results

| **VRTB-L-B1_08232022** | **Collect Date** | 08/23/2022 12:40 | **Lab ID** | 22208314201 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 02:29 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **4.06J** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **9.14J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **9.03J** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **13.7** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **11.0** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **196** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **19.3** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **6.05J** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **885** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **29.1** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **14.9** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **13.8** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-B1_08232022** | **Collect Date** | 08/23/2022 12:40 | **Lab ID** | 22208314201 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 02:29 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 522 | ng/L | 104 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 177 | ng/L | 71 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 189 | ng/L | 75 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 269 | ng/L | 107 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 169 | ng/L | 67 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 145 | ng/L | 58 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 268 | ng/L | 107 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 250 | ng/L | 100 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 255 | ng/L | 102 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 127 | ng/L | 51 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 142 | ng/L | 57 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 253 | ng/L | 101 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 252 | ng/L | 101 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 264 | ng/L | 106 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 275 | ng/L | 110 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 239 | ng/L | 96 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 264 | ng/L | 105 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 254 | ng/L | 102 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 264 | ng/L | 106 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 249 | ng/L | 100 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 235 | ng/L | 94 | 50 - 150 |

# Sample Results

| **VRTB-L-B1_08232022** | | | | |
|---|---|---|---|---|
| | **Collect Date** | 08/23/2022 12:40 | **Lab ID** | 22208314201 |
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 15:36 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **10.6** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **52.5** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **11.7** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **12.4** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **187** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **147** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **5.67J** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **798** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **27.9** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **15.6** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **54.9** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-B1_08232022** | **Collect Date** | 08/23/2022 12:40 | **Lab ID** | 22208314201 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 15:36 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 432 | ng/L | 86 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 205 | ng/L | 82 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 190 | ng/L | 76 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 242 | ng/L | 97 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 264 | ng/L | 105 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 191 | ng/L | 76 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 194 | ng/L | 78 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 262 | ng/L | 105 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 228 | ng/L | 91 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 233 | ng/L | 93 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 277 | ng/L | 111 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 301 | ng/L | 120 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 254 | ng/L | 102 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 252 | ng/L | 101 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 262 | ng/L | 105 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 264 | ng/L | 106 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 259 | ng/L | 104 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 246 | ng/L | 99 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 248 | ng/L | 99 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 217 | ng/L | 87 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 236 | ng/L | 94 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 248 | ng/L | 99 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 254 | ng/L | 102 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 230 | ng/L | 92 | 50 - 150 |

# Sample Results

| **VRTB-L-S2_08232022** | **Collect Date** | 08/23/2022 13:25 | **Lab ID** | 22208314202 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 02:43 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **26.1** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **43.5** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **9.45J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **11.7** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **21.8** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **21.6** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **382** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **27.2** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **18.7** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **2920** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **65.2** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **16.3** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **16.7** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-S2_08232022** | **Collect Date** | 08/23/2022 13:25 | **Lab ID** | 22208314202 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 02:43 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 480 | ng/L | 96 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 73.3 | ng/L | **29*** | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 97.4 | ng/L | **39*** | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 226 | ng/L | 90 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 237 | ng/L | 95 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 95.1 | ng/L | **38*** | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 76.8 | ng/L | **31*** | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 277 | ng/L | 111 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 237 | ng/L | 95 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 242 | ng/L | 97 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 158 | ng/L | 63 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 132 | ng/L | 53 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 204 | ng/L | 81 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 263 | ng/L | 105 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 258 | ng/L | 103 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 230 | ng/L | 92 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 219 | ng/L | 88 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 249 | ng/L | 99 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 179 | ng/L | 72 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 247 | ng/L | 99 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 239 | ng/L | 96 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 246 | ng/L | 98 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 207 | ng/L | 83 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 215 | ng/L | 86 | 50 - 150 |

# Sample Results

| **VRTB-L-S2_08232022** | **Collect Date** | 08/23/2022 13:25 | **Lab ID** | 22208314202 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 15:51 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **8.02J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **96.0** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **18.2** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **39.3** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **333** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **942** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **16.0** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **2590** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **62.7** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **13.2** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **227** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-S2_08232022** | **Collect Date** | 08/23/2022 13:25 | **Lab ID** | 22208314202 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 15:51 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 402 | ng/L | 80 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 157 | ng/L | 63 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 148 | ng/L | 59 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 173 | ng/L | 69 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 195 | ng/L | 78 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 158 | ng/L | 63 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 155 | ng/L | 62 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 289 | ng/L | 115 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 260 | ng/L | 104 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 246 | ng/L | 98 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 272 | ng/L | 109 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 236 | ng/L | 95 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 321 | ng/L | 128 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 283 | ng/L | 113 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 275 | ng/L | 110 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 271 | ng/L | 108 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 260 | ng/L | 104 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 218 | ng/L | 87 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 206 | ng/L | 82 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 192 | ng/L | 77 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 265 | ng/L | 106 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 233 | ng/L | 93 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 231 | ng/L | 92 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 261 | ng/L | 105 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 197 | ng/L | 79 | 50 - 150 |

# Sample Results

| **VRTB-L-Y3_08232022** | **Collect Date** | 08/23/2022 14:20 | **Lab ID** | 22208314203 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 03:13 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **63.5** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **113** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **5.60J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **10.3** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **42.0** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **34.7** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **611** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **27.1** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **53.3** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **128** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **10.4** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **19.6** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-Y3_08232022** | **Collect Date** | 08/23/2022 14:20 | **Lab ID** | 22208314203 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 03:13 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 524 | ng/L | 105 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 146 | ng/L | 58 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 169 | ng/L | 68 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 252 | ng/L | 101 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 275 | ng/L | 110 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 180 | ng/L | 72 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 177 | ng/L | 71 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 273 | ng/L | 109 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 247 | ng/L | 99 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 271 | ng/L | 108 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 276 | ng/L | 110 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 249 | ng/L | 99 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 258 | ng/L | 103 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 253 | ng/L | 101 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 269 | ng/L | 108 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 262 | ng/L | 105 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 271 | ng/L | 108 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 275 | ng/L | 110 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 206 | ng/L | 82 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 239 | ng/L | 96 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 259 | ng/L | 104 | 50 - 150 |

# Sample Results

| VRTB-L-Y3_08232022 | | | | |
|---|---|---|---|---|
| | Collect Date | 08/23/2022 14:20 | Lab ID | 22208314203 |
| | Receive Date | 08/31/2022 09:27 | Matrix | Water |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 5 | 10/19/22 06:58 | 752181 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **11200** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 87 | ng/L | 87 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 207 | ng/L | 83 | 50 - 150 |

# Sample Results

| **VRTB-L-Y3_08232022** | | | | |
|---|---|---|---|---|
| | **Collect Date** | 08/23/2022 14:20 | **Lab ID** | 22208314203 |
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 16:20 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **4.61J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **95.0** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **35.6** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **87.7** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **570** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **2160** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **47.1** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **158** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **10.0** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **323** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-Y3_08232022** | **Collect Date** | 08/23/2022 14:20 | **Lab ID** | 22208314203 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 16:20 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 453 | ng/L | 91 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 194 | ng/L | 78 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 190 | ng/L | 76 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 189 | ng/L | 76 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 224 | ng/L | 90 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 165 | ng/L | 66 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 174 | ng/L | 69 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 274 | ng/L | 110 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 244 | ng/L | 98 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 232 | ng/L | 93 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 219 | ng/L | 88 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 318 | ng/L | 127 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 269 | ng/L | 108 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 258 | ng/L | 103 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 269 | ng/L | 107 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 242 | ng/L | 97 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 224 | ng/L | 90 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 194 | ng/L | 78 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 190 | ng/L | 76 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 223 | ng/L | 89 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 269 | ng/L | 107 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 204 | ng/L | 81 | 50 - 150 |

# Sample Results

| VRTB-L-Y3_08232022 | | | | |
|---|---|---|---|---|
| | Collect Date | 08/23/2022 14:20 | Lab ID | 22208314203 |
| | Receive Date | 08/31/2022 09:27 | Matrix | Water |

## PFAS Top Assay QSM B15 (Post)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 5 | 10/19/22 12:56 | 752183 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **9630** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 78.2 | ng/L | 78 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 203 | ng/L | 81 | 50 - 150 |

# Sample Results

| **VRTB-L-G4_08232022** | **Collect Date** | 08/23/2022 15:10 | **Lab ID** | 22208314204 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 03:27 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **79.7** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **39.4** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **8.47J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **34.7** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **47.1** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **126** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1800** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **104** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **22.0** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **2520** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **204** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **29.2** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **61.8** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-G4_08232022** | **Collect Date** | 08/23/2022 15:10 | **Lab ID** | 22208314204 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 03:27 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 501 | ng/L | 100 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 143 | ng/L | 57 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 158 | ng/L | 63 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 239 | ng/L | 96 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 248 | ng/L | 99 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 169 | ng/L | 68 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 152 | ng/L | 61 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 253 | ng/L | 101 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 234 | ng/L | 94 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 242 | ng/L | 97 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 187 | ng/L | 75 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 194 | ng/L | 78 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 238 | ng/L | 95 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 246 | ng/L | 99 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 232 | ng/L | 93 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 257 | ng/L | 103 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 249 | ng/L | 99 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 261 | ng/L | 104 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 225 | ng/L | 90 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 254 | ng/L | 102 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 236 | ng/L | 94 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 252 | ng/L | 101 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 238 | ng/L | 95 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 236 | ng/L | 94 | 50 - 150 |

# Sample Results

| **VRTB-L-G4_08232022** | **Collect Date** | 08/23/2022 15:10 | **Lab ID** | 22208314204 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 16:36 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **7.90J** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **120** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **42.2** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **144** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1630** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **1130** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **20.6** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **2380** | 1.90 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **202** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **28.5** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **275** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-G4_08232022** | **Collect Date** | 08/23/2022 15:10 | **Lab ID** | 22208314204 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 16:36 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 449 | ng/L | 90 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 211 | ng/L | 85 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 196 | ng/L | 78 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 234 | ng/L | 94 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 267 | ng/L | 107 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 198 | ng/L | 79 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 190 | ng/L | 76 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 287 | ng/L | 115 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 255 | ng/L | 102 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 260 | ng/L | 104 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 240 | ng/L | 96 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 319 | ng/L | 127 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 270 | ng/L | 108 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 254 | ng/L | 102 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 270 | ng/L | 108 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 264 | ng/L | 105 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 263 | ng/L | 105 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 254 | ng/L | 102 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 216 | ng/L | 86 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 270 | ng/L | 108 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 239 | ng/L | 95 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 240 | ng/L | 96 | 50 - 150 |

# Sample Results

| **VRTB-L-M5_08232022** | **Collect Date** | 08/23/2022 16:20 | **Lab ID** | 22208314205 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 03:42 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **171** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **44.9** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **15.0** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **46.5** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **75.5** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **141** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1720** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **170** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **68.8** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | **Perfluorooctane Sulfonamide (FOSA)** | **2.83J** | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **231** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **42.5** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **114** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-M5_08232022** | **Collect Date** | 08/23/2022 16:20 | **Lab ID** | 22208314205 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 03:42 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 491 | ng/L | 98 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 116 | ng/L | 47* | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 132 | ng/L | 53 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 234 | ng/L | 94 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 259 | ng/L | 104 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 135 | ng/L | 54 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 123 | ng/L | 49* | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 258 | ng/L | 103 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 231 | ng/L | 92 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 247 | ng/L | 99 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 217 | ng/L | 87 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 189 | ng/L | 76 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 233 | ng/L | 93 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 237 | ng/L | 95 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 227 | ng/L | 91 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 247 | ng/L | 99 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 241 | ng/L | 96 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 233 | ng/L | 93 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 259 | ng/L | 104 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 256 | ng/L | 102 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 213 | ng/L | 85 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 250 | ng/L | 100 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 197 | ng/L | 79 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 228 | ng/L | 91 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 222 | ng/L | 89 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 225 | ng/L | 90 | 50 - 150 |

# Sample Results

| **VRTB-L-M5_08232022** | **Collect Date** | 08/23/2022 16:20 | **Lab ID** | 22208314205 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 5 | 10/19/22 07:13 | 752181 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **13400** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 82.3 | ng/L | 82 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 184 | ng/L | 74 | 50 - 150 |

# Sample Results

| **VRTB-L-M5_08232022** | **Collect Date** | 08/23/2022 16:20 | **Lab ID** | 22208314205 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 16:50 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **14.2** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **172** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **57.8** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **177** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1470** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **1800** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **52.7** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **215** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **41.9** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **468** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-M5_08232022** | **Collect Date** | 08/23/2022 16:20 | **Lab ID** | 22208314205 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 16:50 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 397 | ng/L | 79 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 206 | ng/L | 82 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 198 | ng/L | 79 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 228 | ng/L | 91 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 254 | ng/L | 101 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 186 | ng/L | 74 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 179 | ng/L | 72 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 295 | ng/L | 118 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 252 | ng/L | 101 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 265 | ng/L | 106 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 266 | ng/L | 106 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 244 | ng/L | 98 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 335 | ng/L | 134 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 274 | ng/L | 109 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 254 | ng/L | 102 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 278 | ng/L | 111 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 264 | ng/L | 106 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 274 | ng/L | 109 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 264 | ng/L | 106 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 209 | ng/L | 83 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 271 | ng/L | 108 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 202 | ng/L | 81 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 234 | ng/L | 94 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 271 | ng/L | 108 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 230 | ng/L | 92 | 50 - 150 |

# Sample Results

| VRTB-L-M5_08232022 | | | | |
|---|---|---|---|---|
| | Collect Date | 08/23/2022 16:20 | Lab ID | 22208314205 |
| | Receive Date | 08/31/2022 09:27 | Matrix | Water |

## PFAS Top Assay QSM B15 (Post)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 5 | 10/19/22 13:11 | 752183 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **9450** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 71.2 | ng/L | 71 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 216 | ng/L | 87 | 50 - 150 |

# Sample Results

| **VRTB-L-06_08232022** | **Collect Date** | 08/23/2022 17:10 | **Lab ID** | 22208314206 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 03:57 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **197** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **40.3** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **18.2** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **71.1** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **89.4** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **181** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1980** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **233** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **82.2** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **294** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **48.6** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **170** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-06_08232022** | **Collect Date** | 08/23/2022 17:10 | **Lab ID** | 22208314206 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 03:57 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 502 | ng/L | 100 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 145 | ng/L | 58 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 157 | ng/L | 63 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 250 | ng/L | 100 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 269 | ng/L | 108 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 173 | ng/L | 69 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 147 | ng/L | 59 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 269 | ng/L | 108 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 238 | ng/L | 95 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 242 | ng/L | 97 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 224 | ng/L | 89 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 210 | ng/L | 84 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 231 | ng/L | 92 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 243 | ng/L | 97 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 233 | ng/L | 93 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 250 | ng/L | 100 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 270 | ng/L | 108 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 268 | ng/L | 107 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 228 | ng/L | 91 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 261 | ng/L | 104 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 194 | ng/L | 78 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 227 | ng/L | 91 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 231 | ng/L | 92 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 245 | ng/L | 98 | 50 - 150 |

# Sample Results

| **VRTB-L-06_08232022** | | | | |
|---|---|---|---|---|
| | **Collect Date** | 08/23/2022 17:10 | **Lab ID** | 22208314206 |
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 5 | 10/19/22 07:28 | 752181 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **15500** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 94.6 | ng/L | 95 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 221 | ng/L | 89 | 50 - 150 |

# Sample Results

| **VRTB-L-06_08232022** | **Collect Date** | 08/23/2022 17:10 | **Lab ID** | 22208314206 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 17:05 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **16.3** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **184** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **80.5** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **230** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1810** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **2470** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **71.2** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **307** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **47.1** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **536** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-06_08232022** | **Collect Date** | 08/23/2022 17:10 | **Lab ID** | 22208314206 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 17:05 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 424 | ng/L | 85 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 197 | ng/L | 79 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 183 | ng/L | 73 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 213 | ng/L | 85 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 243 | ng/L | 97 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 177 | ng/L | 71 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 177 | ng/L | 71 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 267 | ng/L | 107 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 240 | ng/L | 96 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 252 | ng/L | 101 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 269 | ng/L | 107 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 232 | ng/L | 93 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 307 | ng/L | 123 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 258 | ng/L | 103 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 238 | ng/L | 95 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 262 | ng/L | 105 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 243 | ng/L | 97 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 256 | ng/L | 102 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 201 | ng/L | 81 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 261 | ng/L | 104 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 180 | ng/L | 72 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 218 | ng/L | 87 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 248 | ng/L | 99 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 218 | ng/L | 87 | 50 - 150 |

# Sample Results

| VRTB-L-06_08232022 | | | | |
|---|---|---|---|---|
| | Collect Date | 08/23/2022 17:10 | Lab ID | 22208314206 |
| | Receive Date | 08/31/2022 09:27 | Matrix | Water |

## PFAS Top Assay QSM B15 (Post)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 5 | 10/19/22 13:26 | 752183 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **14100** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 73.7 | ng/L | 74 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 191 | ng/L | 76 | 50 - 150 |

# Sample Results

| **VRTB-L-P7_08232022** | **Collect Date** | 08/23/2022 18:00 | **Lab ID** | 22208314207 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 04:11 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **87.7** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **48.3** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **10.5** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **48.3** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **70.6** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **117** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **928** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **128** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **57.9** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **145** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **21.5** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **122** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-P7_08232022** | **Collect Date** | 08/23/2022 18:00 | **Lab ID** | 22208314207 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 04:11 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 499 | ng/L | 100 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 113 | ng/L | **45*** | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 120 | ng/L | **48*** | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 220 | ng/L | 88 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 232 | ng/L | 93 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 118 | ng/L | **47*** | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 110 | ng/L | **44*** | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 259 | ng/L | 104 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 266 | ng/L | 106 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 234 | ng/L | 93 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 127 | ng/L | 51 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 130 | ng/L | 52 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 230 | ng/L | 92 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 245 | ng/L | 98 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 233 | ng/L | 93 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 252 | ng/L | 101 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 248 | ng/L | 99 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 244 | ng/L | 98 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 256 | ng/L | 102 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 231 | ng/L | 93 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 201 | ng/L | 80 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 250 | ng/L | 100 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 180 | ng/L | 72 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 215 | ng/L | 86 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 233 | ng/L | 93 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 165 | ng/L | 66 | 50 - 150 |

# Sample Results

| VRTB-L-P7_08232022 | | | | |
|---|---|---|---|---|
| | Collect Date | 08/23/2022 18:00 | Lab ID | 22208314207 |
| | Receive Date | 08/31/2022 09:27 | Matrix | Water |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 5 | 10/19/22 07:43 | 752181 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **18700** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 90.8 | ng/L | 91 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 198 | ng/L | 79 | 50 - 150 |

# Sample Results

| **VRTB-L-P7_08232022** | **Collect Date** | 08/23/2022 18:00 | **Lab ID** | 22208314207 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 17:20 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **11.7** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **183** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **58.7** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **148** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **915** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **1310** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **49.8** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **155** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **25.1** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **405** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-P7_08232022** | **Collect Date** | 08/23/2022 18:00 | **Lab ID** | 22208314207 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 17:20 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 426 | ng/L | 85 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 168 | ng/L | 67 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 165 | ng/L | 66 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 224 | ng/L | 90 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 250 | ng/L | 100 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 164 | ng/L | 66 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 166 | ng/L | 66 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 272 | ng/L | 109 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 235 | ng/L | 94 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 234 | ng/L | 94 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 273 | ng/L | 109 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 233 | ng/L | 93 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 315 | ng/L | 126 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 258 | ng/L | 103 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 250 | ng/L | 100 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 259 | ng/L | 104 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 250 | ng/L | 100 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 253 | ng/L | 101 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 247 | ng/L | 99 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 239 | ng/L | 96 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 211 | ng/L | 84 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 175 | ng/L | 70 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 215 | ng/L | 86 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 246 | ng/L | 98 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 219 | ng/L | 88 | 50 - 150 |

# Sample Results

| VRTB-L-P7_08232022 | | | | |
|---|---|---|---|---|
| | Collect Date | 08/23/2022 18:00 | Lab ID | 22208314207 |
| | Receive Date | 08/31/2022 09:27 | Matrix | Water |

## PFAS Top Assay QSM B15 (Post)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 5 | 10/19/22 13:41 | 752183 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **15100** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 73.7 | ng/L | 74 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 196 | ng/L | 78 | 50 - 150 |

# Sample Results

| **VRTB-L-BB8_08232022** | **Collect Date** | 08/23/2022 18:40 | **Lab ID** | 22208314208 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 04:26 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | **6:2 Fluorotelomer sulfonic acid (6:2FTS)** | **73.6** | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | **8:2 Fluorotelomer sulfonic acid (8:2 FTS)** | **20.5** | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **23.7** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **58.9** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **68.6** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **140** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1780** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **222** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **46.4** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **175** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **55.5** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **159** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-BB8_08232022** | **Collect Date** | 08/23/2022 18:40 | **Lab ID** | 22208314208 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 1 | 10/11/22 04:26 | 751527 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 465 | ng/L | 93 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 135 | ng/L | 54 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 160 | ng/L | 64 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 237 | ng/L | 95 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 258 | ng/L | 103 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 148 | ng/L | 59 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 135 | ng/L | 54 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 267 | ng/L | 107 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 239 | ng/L | 96 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 230 | ng/L | 92 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 175 | ng/L | 70 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 193 | ng/L | 77 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 230 | ng/L | 92 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 249 | ng/L | 100 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 225 | ng/L | 90 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 248 | ng/L | 99 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 241 | ng/L | 96 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 245 | ng/L | 98 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 255 | ng/L | 102 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 261 | ng/L | 105 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 217 | ng/L | 87 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 251 | ng/L | 100 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 205 | ng/L | 82 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 231 | ng/L | 92 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 236 | ng/L | 94 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 233 | ng/L | 93 | 50 - 150 |

# Sample Results

| **VRTB-L-BB8_08232022** | | | | |
|---|---|---|---|---|
| | **Collect Date** | 08/23/2022 18:40 | **Lab ID** | 22208314208 |
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Pre)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/08/22 09:00 | 750661 | PFAS Top Assay QSM B15 (Pre) | 5 | 10/19/22 07:58 | 752181 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **9090** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 88 | ng/L | 88 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 223 | ng/L | 89 | 50 - 150 |

# Sample Results

| **VRTB-L-BB8_08232022** | **Collect Date** | 08/23/2022 18:40 | **Lab ID** | 22208314208 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 17:35 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 120226-60-0 | 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 4.25 | 8.75 | 10.0 | ng/L |
| 763051-92-9 | 11Cl-PF3OUdS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 757124-72-4 | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 27619-97-2 | 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 3.75 | 7.50 | 10.0 | ng/L |
| 39108-34-4 | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 7.50U | 2.65 | 7.50 | 10.0 | ng/L |
| 756426-58-1 | 9Cl-PF3ONS | 5.00U | 2.25 | 5.00 | 10.0 | ng/L |
| 919005-14-4 | ADONA | 5.00U | 2.15 | 5.00 | 10.0 | ng/L |
| 4151-50-2 | NEtFOSA | 10.0U | 3.50 | 10.0 | 20.0 | ng/L |
| 2991-50-6 | NEtFOSAA | 10.0U | 3.95 | 10.0 | 20.0 | ng/L |
| 1691-99-2 | NEtFOSE | 10.0U | 2.53 | 10.0 | 20.0 | ng/L |
| 31506-32-8 | NMeFOSA | 10.0U | 4.15 | 10.0 | 20.0 | ng/L |
| 2355-31-9 | NMeFOSAA | 10.0U | 2.25 | 10.0 | 20.0 | ng/L |
| 24448-09-7 | NMeFOSE | 10.0U | 3.25 | 10.0 | 20.0 | ng/L |
| 151772-58-6 | Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 113507-82-7 | Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 3.88 | 8.75 | 10.0 | ng/L |
| 13252-13-6 | Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 4.33 | 10.0 | 20.0 | ng/L |
| 377-73-1 | Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 3.48 | 7.50 | 10.0 | ng/L |
| 863090-89-5 | Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |
| 375-73-5 | **Perfluorobutanesulfonic acid (PFBS)** | **25.5** | 1.55 | 5.00 | 10.0 | ng/L |
| 375-22-4 | **Perfluorobutanoic acid (PFBA)** | **212** | 3.80 | 8.75 | 10.0 | ng/L |
| 335-77-3 | Perfluorodecane sulfonic acid (PFDS) | 7.50U | 3.05 | 7.50 | 10.0 | ng/L |
| 335-76-2 | Perfluorodecanoic acid (PFDA) | 7.50U | 3.60 | 7.50 | 10.0 | ng/L |
| 307-55-1 | Perfluorododecanoic acid (PFDoA) | 7.50U | 3.25 | 7.50 | 10.0 | ng/L |
| 375-92-8 | **Perfluoroheptanesulfonic acid (PFHpS)** | **63.4** | 3.05 | 7.50 | 10.0 | ng/L |
| 375-85-9 | **Perfluoroheptanoic acid (PFHpA)** | **183** | 2.90 | 7.50 | 10.0 | ng/L |
| 355-46-4 | **Perfluorohexanesulfonic acid (PFHxS)** | **1810** | 3.10 | 7.50 | 10.0 | ng/L |
| 307-24-4 | **Perfluorohexanoic acid (PFHxA)** | **2120** | 2.35 | 5.00 | 10.0 | ng/L |
| 68259-12-1 | Perfluorononanesulfonic acid (PFNS) | 8.75U | 4.35 | 8.75 | 10.0 | ng/L |
| 375-95-1 | **Perfluorononanoic acid (PFNA)** | **44.8** | 2.45 | 5.00 | 10.0 | ng/L |
| 754-91-6 | Perfluorooctane Sulfonamide (FOSA) | 5.00U | 1.85 | 5.00 | 10.0 | ng/L |
| 335-67-1 | **Perfluorooctanoic acid (PFOA)** | **186** | 2.10 | 5.00 | 10.0 | ng/L |
| 2706-91-4 | **Perfluoropentanesulfonic acid (PFPeS)** | **67.4** | 2.55 | 7.50 | 10.0 | ng/L |
| 2706-90-3 | **Perfluoropentanoic acid (PFPeA)** | **571** | 2.20 | 5.00 | 10.0 | ng/L |
| 376-06-7 | Perfluorotetradecanoic acid (PFTA) | 7.50U | 2.85 | 7.50 | 10.0 | ng/L |
| 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | 7.50U | 3.08 | 7.50 | 10.0 | ng/L |
| 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | 7.50U | 3.10 | 7.50 | 10.0 | ng/L |
| 79780-39-5 | PFDoS | 7.50U | 3.28 | 7.50 | 10.0 | ng/L |
| 67905-19-5 | PFHxDA | 8.75U | 3.75 | 8.75 | 10.0 | ng/L |

# Sample Results

| **VRTB-L-BB8_08232022** | **Collect Date** | 08/23/2022 18:40 | **Lab ID** | 22208314208 |
|---|---|---|---|---|
| | **Receive Date** | 08/31/2022 09:27 | **Matrix** | Water |

## PFAS Top Assay QSM B15 (Post) (Continued)

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 1 | 10/10/22 17:35 | 751501 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 16517-11-6 | PFODA | 7.50U | 2.58 | 7.50 | 10.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 500 | 395 | ng/L | 79 | 50 - 150 |
| 4151-50-2-EIS | d-NEtFOSA | 250 | 161 | ng/L | 64 | 50 - 150 |
| 31506-32-8-EIS | d-NMeFOSA | 250 | 153 | ng/L | 61 | 50 - 150 |
| 2355-31-9-EIS | d3-NMeFOSAA | 250 | 178 | ng/L | 71 | 50 - 150 |
| 2991-50-6-EIS | d5-NEtFOSAA | 250 | 201 | ng/L | 80 | 50 - 150 |
| 24448-09-7-EIS | d7-NMeFOSE | 250 | 149 | ng/L | 60 | 50 - 150 |
| 1691-99-2-EIS | d9-NEtFOSE | 250 | 146 | ng/L | 58 | 50 - 150 |
| 757124-72-4-EIS | M2 4:2 FTS | 250 | 232 | ng/L | 93 | 50 - 150 |
| 27619-97-2-EIS | M2 6:2 FTS | 250 | 211 | ng/L | 84 | 50 - 150 |
| 39108-34-4-EIS | M2 8:2 FTS | 250 | 191 | ng/L | 76 | 50 - 150 |
| 67905-19-5-EIS | M2PFHxDA | 250 | 218 | ng/L | 87 | 50 - 150 |
| 376-06-7-EIS | M2PFTA | 250 | 190 | ng/L | 76 | 50 - 150 |
| 13252-13-6-EIS | M3HFPODA | 250 | 288 | ng/L | 115 | 50 - 150 |
| 375-73-5-EIS | M3PFBS | 250 | 230 | ng/L | 92 | 50 - 150 |
| 355-46-4-EIS | M3PFHxS | 250 | 211 | ng/L | 84 | 50 - 150 |
| 375-85-9-EIS | M4PFHpA | 250 | 236 | ng/L | 94 | 50 - 150 |
| 307-24-4-EIS | M5PFHxA | 250 | 222 | ng/L | 89 | 50 - 150 |
| 2706-90-3-EIS | M5PFPeA | 250 | 227 | ng/L | 91 | 50 - 150 |
| 335-76-2-EIS | M6PFDA | 250 | 204 | ng/L | 82 | 50 - 150 |
| 2058-94-8-EIS | M7PFUnA | 250 | 196 | ng/L | 78 | 50 - 150 |
| 754-91-6-EIS | M8FOSA | 250 | 161 | ng/L | 64 | 50 - 150 |
| 335-67-1-EIS | M8PFOA | 250 | 234 | ng/L | 94 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 166 | ng/L | 66 | 50 - 150 |
| 375-95-1-EIS | M9PFNA | 250 | 196 | ng/L | 78 | 50 - 150 |
| 375-22-4-EIS | MPFBA | 250 | 224 | ng/L | 89 | 50 - 150 |
| 307-55-1-EIS | MPFDoA | 250 | 180 | ng/L | 72 | 50 - 150 |

# Sample Results

| VRTB-L-BB8_08232022 | | | | |
|---|---|---|---|---|
| | Collect Date | 08/23/2022 18:40 | Lab ID | 22208314208 |
| | Receive Date | 08/31/2022 09:27 | Matrix | Water |

## PFAS Top Assay QSM B15 (Post)

*Results and limits are adjusted for dilution.

| Prep Date | Prep Batch | Prep Method | Dilution | Run Date | Run Batch | Analyst | %Moisture |
|---|---|---|---|---|---|---|---|
| 10/07/22 11:45 | 751390 | PFAS Top Assay QSM B15 (Post) | 5 | 10/19/22 13:56 | 752183 | SLR2 | NA |

| CAS# | Parameter | Result | DL | LOD | LOQ | Units |
|---|---|---|---|---|---|---|
| 1763-23-1 | **Perfluorooctanesulfonic acid (PFOS)** | **9030** | 9.50 | 25.0 | 50.0 | ng/L |

| CAS# | Extracted Internal Standard(EIS) | Cal Area | Samp Area | Units | %Recovery | %Rec Limits |
|---|---|---|---|---|---|---|
| 335-67-1-SUR | MPFOA | 100 | 70.3 | ng/L | 70 | 50 - 150 |
| 1763-23-1-EIS | M8PFOS | 250 | 170 | ng/L | 68 | 50 - 150 |

# LC-MS/MS QC Summary

| **Analytical Batch** | | MB751390 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 751501 | Client ID | 2405471 | | LCS751390 | | | | LCSD751390 | | | | |
| **Prep Batch** | Lab ID | MB | | 2405472 | | | | 2405473 | | | | |
| 751390 | Sample Type | 10/07/22 | | LCS | | | | LCSD | | | | |
| **Prep Method** | Prep Date | 11:45 | | 10/07/22 11:45 | | | | 10/07/22 11:45 | | | | |
| PFAS Top Assay QSM B15 (Post) | Analysis Date | 10/10/22 | | 10/10/22 12:52 | | | | 10/10/22 13:07 | | | | |
| | Matrix | 12:37 | | Water | | | | Water | | | | |
| **PFAS Top Assay QSM B15 (Post)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 120226-60-0 | 8.75U | 8.75 | 193 | 223 | 116 | 70 - 130 | 193 | 213 | 110 | 5 | 20 |
| 11Cl-PF3OUdS | 763051-92-9 | 5.00U | 5.00 | 189 | 205 | 109 | 70 - 130 | 189 | 203 | 108 | 1 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 7.50U | 7.50 | 187 | 208 | 111 | 70 - 130 | 187 | 198 | 106 | 5 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 7.50U | 7.50 | 190 | 206 | 108 | 70 - 130 | 190 | 209 | 110 | 1 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 7.50U | 7.50 | 192 | 215 | 112 | 70 - 130 | 192 | 209 | 109 | 3 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 5.00U | 5.00 | 187 | 204 | 110 | 70 - 130 | 187 | 196 | 105 | 4 | 20 |
| ADONA | 919005-14-4 | 5.00U | 5.00 | 189 | 207 | 110 | 70 - 130 | 189 | 195 | 103 | 6 | 20 |
| NEtFOSA | 4151-50-2 | 10.0U | 10.0 | 200 | 233 | 116 | 70 - 130 | 200 | 206 | 103 | 12 | 20 |
| NEtFOSAA | 2991-50-6 | 10.0U | 10.0 | 200 | 207 | 103 | 70 - 130 | 200 | 196 | 98 | 5 | 20 |
| NEtFOSE | 1691-99-2 | 10.0U | 10.0 | 200 | 223 | 112 | 70 - 130 | 200 | 219 | 109 | 2 | 20 |
| NMeFOSA | 31506-32-8 | 10.0U | 10.0 | 200 | 237 | 119 | 70 - 130 | 200 | 220 | 110 | 7 | 20 |
| NMeFOSAA | 2355-31-9 | 10.0U | 10.0 | 200 | 225 | 113 | 70 - 130 | 200 | 212 | 106 | 6 | 20 |
| NMeFOSE | 24448-09-7 | 10.0U | 10.0 | 200 | 216 | 108 | 70 - 130 | 200 | 214 | 107 | 1 | 20 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 8.75U | 8.75 | 200 | 221 | 111 | 70 - 130 | 200 | 209 | 104 | 6 | 20 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 8.75U | 8.75 | 178 | 194 | 109 | 70 - 130 | 178 | 186 | 105 | 4 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 10.0U | 10.0 | 400 | 437 | 109 | 70 - 130 | 400 | 445 | 111 | 2 | 20 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 7.50U | 7.50 | 200 | 219 | 110 | 70 - 130 | 200 | 214 | 107 | 3 | 20 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 8.75U | 8.75 | 200 | 212 | 106 | 70 - 130 | 200 | 206 | 103 | 3 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 5.00U | 5.00 | 177 | 195 | 110 | 70 - 130 | 177 | 191 | 107 | 2 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 8.75U | 8.75 | 200 | 221 | 110 | 70 - 130 | 200 | 216 | 108 | 2 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 7.50U | 7.50 | 193 | 216 | 112 | 70 - 130 | 193 | 206 | 107 | 5 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 7.50U | 7.50 | 200 | 219 | 109 | 70 - 130 | 200 | 216 | 108 | 1 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 7.50U | 7.50 | 200 | 219 | 109 | 70 - 130 | 200 | 211 | 106 | 3 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 7.50U | 7.50 | 191 | 211 | 111 | 70 - 130 | 191 | 205 | 108 | 3 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 7.50U | 7.50 | 200 | 217 | 108 | 70 - 130 | 200 | 211 | 105 | 3 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 7.50U | 7.50 | 183 | 201 | 110 | 70 - 130 | 183 | 195 | 107 | 3 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 5.00U | 5.00 | 200 | 219 | 110 | 70 - 130 | 200 | 214 | 107 | 2 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 8.75U | 8.75 | 192 | 208 | 108 | 70 - 130 | 192 | 207 | 108 | 1 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 5.00U | 5.00 | 200 | 219 | 109 | 70 - 130 | 200 | 210 | 105 | 4 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 5.00U | 5.00 | 200 | 229 | 115 | 70 - 130 | 200 | 219 | 110 | 4 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 5.00U | 5.00 | 186 | 208 | 112 | 70 - 130 | 186 | 194 | 104 | 7 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 5.00U | 5.00 | 200 | 220 | 110 | 70 - 130 | 200 | 209 | 104 | 5 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 7.50U | 7.50 | 188 | 212 | 113 | 70 - 130 | 188 | 205 | 109 | 3 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 5.00U | 5.00 | 200 | 221 | 110 | 70 - 130 | 200 | 216 | 108 | 2 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 7.50U | 7.50 | 200 | 218 | 109 | 70 - 130 | 200 | 216 | 108 | 1 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 7.50U | 7.50 | 200 | 216 | 108 | 70 - 130 | 200 | 220 | 110 | 2 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 7.50U | 7.50 | 200 | 215 | 107 | 70 - 130 | 200 | 209 | 105 | 3 | 20 |
| PFDoS | 79780-39-5 | 7.50U | 7.50 | 194 | 202 | 104 | 70 - 130 | 194 | 206 | 106 | 2 | 20 |
| PFHxDA | 67905-19-5 | 8.75U | 8.75 | 200 | 222 | 111 | 70 - 130 | 200 | 234 | 117 | 5 | 20 |
| PFODA | 16517-11-6 | 7.50U | 7.50 | 200 | 187 | 93 | 70 - 130 | 200 | 208 | 104 | 11 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 217 | 87 | 250 | 225 | 90 | 50 - 150 | 250 | 231 | 92 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 247 | 99 | 250 | 253 | 101 | 50 - 150 | 250 | 256 | 102 | NA | NA |
| d7-NMeFOSE | 24448-09-7-EIS | 169 | 68 | 250 | 179 | 71 | 50 - 150 | 250 | 169 | 68 | NA | NA |
| d9-NEtFOSE | 1691-99-2-EIS | 168 | 67 | 250 | 173 | 69 | 50 - 150 | 250 | 169 | 68 | NA | NA |
| d-NEtFOSA | 4151-50-2-EIS | 151 | 60 | 250 | 160 | 64 | 50 - 150 | 250 | 162 | 65 | NA | NA |
| d-NMeFOSA | 31506-32-8-EIS | 146 | 58 | 250 | 158 | 63 | 50 - 150 | 250 | 153 | 61 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 225 | 90 | 250 | 223 | 89 | 50 - 150 | 250 | 235 | 94 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 206 | 83 | 250 | 207 | 83 | 50 - 150 | 250 | 222 | 89 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 236 | 95 | 250 | 223 | 89 | 50 - 150 | 250 | 248 | 99 | NA | NA |
| M2PFHxDA | 67905-19-5-EIS | 232 | 93 | 250 | 239 | 95 | 50 - 150 | 250 | 261 | 104 | NA | NA |
| M2PFTA | 376-06-7-EIS | 201 | 80 | 250 | 208 | 83 | 50 - 150 | 250 | 228 | 91 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 243 | 97 | 250 | 275 | 110 | 50 - 150 | 250 | 249 | 100 | NA | NA |
| M3PFBS | 375-73-5-EIS | 208 | 83 | 250 | 218 | 87 | 50 - 150 | 250 | 221 | 88 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 212 | 85 | 250 | 222 | 89 | 50 - 150 | 250 | 230 | 92 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 219 | 88 | 250 | 229 | 92 | 50 - 150 | 250 | 219 | 88 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 215 | 86 | 250 | 230 | 92 | 50 - 150 | 250 | 216 | 86 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 210 | 84 | 250 | 223 | 89 | 50 - 150 | 250 | 211 | 84 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB751390 | LCS751390 | LCSD751390 |
|---|---|---|---|---|
| 751501 | Lab ID | 2405471 | 2405472 | 2405473 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 751390 | Prep Date | 10/07/22 11:45 | 10/07/22 11:45 | 10/07/22 11:45 |
| **Prep Method** | Analysis Date | 10/10/22 12:37 | 10/10/22 12:52 | 10/10/22 13:07 |
| PFAS Top Assay QSM B15 (Post) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Post)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M6PFDA | 335-76-2-EIS | 227 | 91 | 250 | 230 | 92 | 50 - 150 | 250 | 223 | 89 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 224 | 90 | 250 | 233 | 93 | 50 - 150 | 250 | 232 | 93 | NA | NA |
| M8FOSA | 754-91-6-EIS | 199 | 80 | 250 | 205 | 82 | 50 - 150 | 250 | 197 | 79 | NA | NA |
| M8PFOA | 335-67-1-EIS | 220 | 88 | 250 | 228 | 91 | 50 - 150 | 250 | 224 | 90 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 214 | 85 | 250 | 222 | 89 | 50 - 150 | 250 | 237 | 95 | NA | NA |
| M9PFNA | 375-95-1-EIS | 223 | 89 | 250 | 227 | 91 | 50 - 150 | 250 | 222 | 89 | NA | NA |
| MPFBA | 375-22-4-EIS | 207 | 83 | 250 | 222 | 89 | 50 - 150 | 250 | 208 | 83 | NA | NA |
| MPFDoA | 307-55-1-EIS | 214 | 85 | 250 | 219 | 88 | 50 - 150 | 250 | 232 | 93 | NA | NA |
| MPFOA | 335-67-1-SUR | 448 | 90 | 500 | 463 | 93 | 50 - 150 | 500 | 434 | 87 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | | MB750661 | | LCS750661 | | | | LCSD750661 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 751527 | Client ID | 2400713 | | 2400714 | | | | 2400715 | | | | |
| **Prep Batch** | Lab ID | MB | | LCS | | | | LCSD | | | | |
| 750661 | Sample Type | 10/08/22 09:00 | | 10/08/22 09:00 | | | | 10/08/22 09:00 | | | | |
| **Prep Method** | Prep Date | 10/10/22 23:48 | | 10/11/22 00:02 | | | | 10/11/22 00:17 | | | | |
| PFAS Top Assay QSM B15 (Pre) | Analysis Date | | | | | | | | | | | |
| | Matrix | Water | | Water | | | | Water | | | | |

| **PFAS Top Assay QSM B15 (Pre)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 120226-60-0 | 8.75U | 8.75 | 193 | 191 | 99 | 70 - 130 | 193 | 193 | 100 | 1 | 20 |
| 11Cl-PF3OUdS | 763051-92-9 | 5.00U | 5.00 | 189 | 203 | 108 | 70 - 130 | 189 | 199 | 106 | 2 | 20 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 757124-72-4 | 7.50U | 7.50 | 187 | 228 | 122 | 70 - 130 | 187 | 204 | 109 | 11 | 20 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 27619-97-2 | 7.50U | 7.50 | 190 | 216 | 114 | 70 - 130 | 190 | 211 | 111 | 2 | 20 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 39108-34-4 | 7.50U | 7.50 | 192 | 213 | 111 | 70 - 130 | 192 | 212 | 111 | 0 | 20 |
| 9Cl-PF3ONS | 756426-58-1 | 5.00U | 5.00 | 187 | 202 | 108 | 70 - 130 | 187 | 194 | 104 | 4 | 20 |
| ADONA | 919005-14-4 | 5.00U | 5.00 | 189 | 206 | 109 | 70 - 130 | 189 | 193 | 102 | 6 | 20 |
| NEtFOSA | 4151-50-2 | 10.0U | 10.0 | 200 | 215 | 107 | 70 - 130 | 200 | 187 | 93 | 14 | 20 |
| NEtFOSAA | 2991-50-6 | 10.0U | 10.0 | 200 | 213 | 107 | 70 - 130 | 200 | 207 | 104 | 3 | 20 |
| NEtFOSE | 1691-99-2 | 10.0U | 10.0 | 200 | 213 | 107 | 70 - 130 | 200 | 201 | 101 | 6 | 20 |
| NMeFOSA | 31506-32-8 | 10.0U | 10.0 | 200 | 220 | 110 | 70 - 130 | 200 | 188 | 94 | 15 | 20 |
| NMeFOSAA | 2355-31-9 | 10.0U | 10.0 | 200 | 231 | 115 | 70 - 130 | 200 | 216 | 108 | 7 | 20 |
| NMeFOSE | 24448-09-7 | 10.0U | 10.0 | 200 | 222 | 111 | 70 - 130 | 200 | 202 | 101 | 10 | 20 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 8.75U | 8.75 | 200 | 207 | 103 | 70 - 130 | 200 | 196 | 98 | 5 | 20 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 8.75U | 8.75 | 178 | 197 | 110 | 70 - 130 | 178 | 186 | 104 | 6 | 20 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 13252-13-6 | 10.0U | 10.0 | 400 | 451 | 113 | 70 - 130 | 400 | 436 | 109 | 3 | 20 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 7.50U | 7.50 | 200 | 205 | 102 | 70 - 130 | 200 | 196 | 98 | 5 | 20 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 8.75U | 8.75 | 200 | 210 | 105 | 70 - 130 | 200 | 199 | 100 | 5 | 20 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 5.00U | 5.00 | 177 | 193 | 109 | 70 - 130 | 177 | 186 | 105 | 4 | 20 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 8.75U | 8.75 | 200 | 217 | 109 | 70 - 130 | 200 | 203 | 102 | 7 | 20 |
| Perfluorodecane sulfonic acid (PFDS) | 335-77-3 | 7.50U | 7.50 | 193 | 205 | 106 | 70 - 130 | 193 | 196 | 102 | 4 | 20 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 7.50U | 7.50 | 200 | 214 | 107 | 70 - 130 | 200 | 206 | 103 | 4 | 20 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 7.50U | 7.50 | 200 | 220 | 110 | 70 - 130 | 200 | 209 | 105 | 5 | 20 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 7.50U | 7.50 | 191 | 215 | 113 | 70 - 130 | 191 | 200 | 105 | 7 | 20 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 7.50U | 7.50 | 200 | 214 | 107 | 70 - 130 | 200 | 206 | 103 | 4 | 20 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 7.50U | 7.50 | 183 | 195 | 107 | 70 - 130 | 183 | 187 | 102 | 4 | 20 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 5.00U | 5.00 | 200 | 211 | 106 | 70 - 130 | 200 | 199 | 99 | 6 | 20 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 8.75U | 8.75 | 192 | 205 | 107 | 70 - 130 | 192 | 193 | 100 | 6 | 20 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 5.00U | 5.00 | 200 | 217 | 109 | 70 - 130 | 200 | 206 | 103 | 5 | 20 |
| Perfluorooctane Sulfonamide (FOSA) | 754-91-6 | 5.00U | 5.00 | 200 | 214 | 107 | 70 - 130 | 200 | 208 | 104 | 3 | 20 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 5.00U | 5.00 | 186 | 198 | 106 | 70 - 130 | 186 | 188 | 101 | 5 | 20 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 5.00U | 5.00 | 200 | 219 | 109 | 70 - 130 | 200 | 206 | 103 | 6 | 20 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 7.50U | 7.50 | 188 | 200 | 106 | 70 - 130 | 188 | 193 | 102 | 4 | 20 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 5.00U | 5.00 | 200 | 216 | 108 | 70 - 130 | 200 | 206 | 103 | 5 | 20 |
| Perfluorotetradecanoic acid (PFTA) | 376-06-7 | 7.50U | 7.50 | 200 | 213 | 107 | 70 - 130 | 200 | 204 | 102 | 4 | 20 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 7.50U | 7.50 | 200 | 218 | 109 | 70 - 130 | 200 | 199 | 100 | 9 | 20 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 7.50U | 7.50 | 200 | 217 | 108 | 70 - 130 | 200 | 204 | 102 | 6 | 20 |
| PFDoS | 79780-39-5 | 7.50U | 7.50 | 194 | 192 | 99 | 70 - 130 | 194 | 199 | 102 | 4 | 20 |
| PFHxDA | 67905-19-5 | 8.75U | 8.75 | 200 | 210 | 105 | 70 - 130 | 200 | 205 | 102 | 3 | 20 |
| PFODA | 16517-11-6 | 7.50U | 7.50 | 200 | 178 | 89 | 70 - 130 | 200 | 201 | 100 | 12 | 20 |
| **Extracted Internal Standard(EIS)** | **CAS#** | **Area** | **%R** | **CalArea** | **Area** | **%R** | **Limits** | **CalArea** | **Area** | **%** | **RPD** | **Limit** |
| d3-NMeFOSAA | 2355-31-9-EIS | 257 | 103 | 250 | 245 | 98 | 50 - 150 | 250 | 258 | 103 | NA | NA |
| d5-NEtFOSAA | 2991-50-6-EIS | 266 | 106 | 250 | 266 | 106 | 50 - 150 | 250 | 274 | 109 | NA | NA |
| d7-NMeFOSE | 24448-09-7-EIS | 188 | 75 | 250 | 192 | 77 | 50 - 150 | 250 | 201 | 80 | NA | NA |
| d9-NEtFOSE | 1691-99-2-EIS | 161 | 64 | 250 | 195 | 78 | 50 - 150 | 250 | 206 | 82 | NA | NA |
| d-NEtFOSA | 4151-50-2-EIS | 103 | **41*** | 250 | 143 | 57 | 50 - 150 | 250 | 155 | 62 | NA | NA |
| d-NMeFOSA | 31506-32-8-EIS | 112 | **45*** | 250 | 144 | 58 | 50 - 150 | 250 | 165 | 66 | NA | NA |
| M2 4:2 FTS | 757124-72-4-EIS | 286 | 115 | 250 | 254 | 102 | 50 - 150 | 250 | 277 | 111 | NA | NA |
| M2 6:2 FTS | 27619-97-2-EIS | 277 | 111 | 250 | 257 | 103 | 50 - 150 | 250 | 260 | 104 | NA | NA |
| M2 8:2 FTS | 39108-34-4-EIS | 277 | 111 | 250 | 275 | 110 | 50 - 150 | 250 | 278 | 111 | NA | NA |
| M2PFHxDA | 67905-19-5-EIS | 261 | 104 | 250 | 266 | 106 | 50 - 150 | 250 | 292 | 117 | NA | NA |
| M2PFTA | 376-06-7-EIS | 241 | 96 | 250 | 232 | 93 | 50 - 150 | 250 | 245 | 98 | NA | NA |
| M3HFPODA | 13252-13-6-EIS | 264 | 106 | 250 | 239 | 96 | 50 - 150 | 250 | 252 | 101 | NA | NA |
| M3PFBS | 375-73-5-EIS | 267 | 107 | 250 | 248 | 99 | 50 - 150 | 250 | 254 | 102 | NA | NA |
| M3PFHxS | 355-46-4-EIS | 269 | 107 | 250 | 244 | 98 | 50 - 150 | 250 | 256 | 102 | NA | NA |
| M4PFHpA | 375-85-9-EIS | 276 | 110 | 250 | 259 | 104 | 50 - 150 | 250 | 268 | 107 | NA | NA |
| M5PFHxA | 307-24-4-EIS | 273 | 109 | 250 | 257 | 103 | 50 - 150 | 250 | 266 | 106 | NA | NA |
| M5PFPeA | 2706-90-3-EIS | 274 | 110 | 250 | 252 | 101 | 50 - 150 | 250 | 261 | 104 | NA | NA |

# LC-MS/MS QC Summary

| **Analytical Batch** | Client ID | MB750661 | LCS750661 | LCSD750661 |
|---|---|---|---|---|
| 751527 | Lab ID | 2400713 | 2400714 | 2400715 |
| **Prep Batch** | Sample Type | MB | LCS | LCSD |
| 750661 | Prep Date | 10/08/22 09:00 | 10/08/22 09:00 | 10/08/22 09:00 |
| **Prep Method** | Analysis Date | 10/10/22 23:48 | 10/11/22 00:02 | 10/11/22 00:17 |
| PFAS Top Assay QSM B15 (Pre) | Matrix | Water | Water | Water |

| **PFAS Top Assay QSM B15 (Pre)** | | Units Result | ng/L LOD | Spike Added | Result | %R | Control Limits%R | Spike Added | Result | %R | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M6PFDA | 335-76-2-EIS | 273 | 109 | 250 | 262 | 105 | 50 - 150 | 250 | 270 | 108 | NA | NA |
| M7PFUnA | 2058-94-8-EIS | 267 | 107 | 250 | 264 | 106 | 50 - 150 | 250 | 277 | 111 | NA | NA |
| M8FOSA | 754-91-6-EIS | 212 | 85 | 250 | 217 | 87 | 50 - 150 | 250 | 211 | 85 | NA | NA |
| M8PFOA | 335-67-1-EIS | 277 | 111 | 250 | 256 | 103 | 50 - 150 | 250 | 268 | 107 | NA | NA |
| M8PFOS | 1763-23-1-EIS | 260 | 104 | 250 | 253 | 101 | 50 - 150 | 250 | 260 | 104 | NA | NA |
| M9PFNA | 375-95-1-EIS | 277 | 111 | 250 | 262 | 105 | 50 - 150 | 250 | 271 | 108 | NA | NA |
| MPFBA | 375-22-4-EIS | 265 | 106 | 250 | 243 | 97 | 50 - 150 | 250 | 257 | 103 | NA | NA |
| MPFDoA | 307-55-1-EIS | 261 | 104 | 250 | 248 | 99 | 50 - 150 | 250 | 264 | 105 | NA | NA |
| MPFOA | 335-67-1-SUR | 532 | 106 | 500 | 521 | 104 | 50 - 150 | 500 | 533 | 107 | NA | NA |

# Top Assay Pre/Post Summary

| Client ID | VRTB-L-B1_08232022 | | | | VRTB-L-S2_08232022 | | | |
|---|---|---|---|---|---|---|---|---|
| LAB ID | 22208314201 | | | | 22208314202 | | | |
| Collected | 08/23/22 12:40 | | | | 08/23/22 13:25 | | | |
| Matrix | Water | | | | Water | | | |
| Units | ng/L | | | | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| 11Cl-PF3OUdS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 7.50U | 7.50U | 0 | 0 | 26.1 | 7.50U | -26.1 | 200 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 4.06J | 7.50U | -4.06 | 200 | 43.5 | 7.50U | -43.5 | 200 |
| 9Cl-PF3ONS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| ADONA | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| NEtFOSA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NEtFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NEtFOSE | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSE | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| PFDoS | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| PFHxDA | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| PFODA | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 9.14J | 10.6 | 1.46 | 14.8 | 9.45J | 8.02J | -1.43 | 16.4 |
| Perfluorobutanoic acid (PFBA) | 9.03J | 52.5 | 43.47 | 141.3 | 11.7 | 96.0 | 84.3 | 156.5 |
| Perfluorodecane sulfonic acid (PFDS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 13.7 | 11.7 | -2 | 15.7 | 21.8 | 18.2 | -3.6 | 18 |
| Perfluoroheptanoic acid (PFHpA) | 11.0 | 12.4 | 1.4 | 12 | 21.6 | 39.3 | 17.7 | 58.1 |
| Perfluorohexanesulfonic acid (PFHxS) | 196 | 187 | -9 | 4.7 | 382 | 333 | -49 | 13.7 |
| Perfluorohexanoic acid (PFHxA) | 19.3 | 147 | 127.7 | 153.6 | 27.2 | 942 | 914.8 | 188.8 |
| Perfluorononanesulfonic acid (PFNS) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 6.05J | 5.67J | -0.38 | 6.5 | 18.7 | 16.0 | -2.7 | 15.6 |
| Perfluorooctane Sulfonamide (FOSA) | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 885 | 798 | -87 | 10.3 | 2920 | 2590 | -330 | 12 |
| Perfluorooctanoic acid (PFOA) | 29.1 | 27.9 | -1.2 | 4.2 | 65.2 | 62.7 | -2.5 | 3.9 |
| Perfluoropentanesulfonic acid (PFPeS) | 14.9 | 15.6 | 0.7 | 4.6 | 16.3 | 13.2 | -3.1 | 21 |
| Perfluoropentanoic acid (PFPeA) | 13.8 | 54.9 | 41.1 | 119.7 | 16.7 | 227 | 210.3 | 172.6 |
| Perfluorotetradecanoic acid (PFTA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| Client ID | VRTB-L-Y3_08232022 | | | | VRTB-L-G4_08232022 | | | |
|---|---|---|---|---|---|---|---|---|
| LAB ID | 22208314203 | | | | 22208314204 | | | |
| Collected | 08/23/22 14:20 | | | | 08/23/22 15:10 | | | |
| Matrix | Water | | | | Water | | | |
| Units | ng/L | | | | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| 11Cl-PF3OUdS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 63.5 | 7.50U | -63.5 | 200 | 79.7 | 7.50U | -79.7 | 200 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 113 | 7.50U | -113 | 200 | 39.4 | 7.50U | -39.4 | 200 |
| 9Cl-PF3ONS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| ADONA | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| NEtFOSA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NEtFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NEtFOSE | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSE | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| PFDoS | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| PFHxDA | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| PFODA | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 5.60J | 4.61J | -0.99 | 19.4 | 8.47J | 7.90J | -0.57 | 7 |
| Perfluorobutanoic acid (PFBA) | 10.3 | 95.0 | 84.7 | 160.9 | 34.7 | 120 | 85.3 | 110.3 |
| Perfluorodecane sulfonic acid (PFDS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 42.0 | 35.6 | -6.4 | 16.5 | 47.1 | 42.2 | -4.9 | 11 |
| Perfluoroheptanoic acid (PFHpA) | 34.7 | 87.7 | 53 | 86.6 | 126 | 144 | 18 | 13.3 |
| Perfluorohexanesulfonic acid (PFHxS) | 611 | 570 | -41 | 6.9 | 1800 | 1630 | -170 | 9.9 |
| Perfluorohexanoic acid (PFHxA) | 27.1 | 2160 | 2132.9 | 195 | 104 | 1130 | 1026 | 166.3 |
| Perfluorononanesulfonic acid (PFNS) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 53.3 | 47.1 | -6.2 | 12.4 | 22.0 | 20.6 | -1.4 | 6.6 |
| Perfluorooctane Sulfonamide (FOSA) | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 11200 | 9630 | -1570 | 15.1 | 2520 | 2380 | -140 | 5.7 |
| Perfluorooctanoic acid (PFOA) | 128 | 158 | 30 | 21 | 204 | 202 | -2 | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 10.4 | 10.0 | -0.4 | 3.9 | 29.2 | 28.5 | -0.7 | 2.4 |
| Perfluoropentanoic acid (PFPeA) | 19.6 | 323 | 303.4 | 177.1 | 61.8 | 275 | 213.2 | 126.6 |
| Perfluorotetradecanoic acid (PFTA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| **Client ID** | VRTB-L-M5_08232022 | | | | VRTB-L-06_08232022 | | | |
|---|---|---|---|---|---|---|---|---|
| **LAB ID** | 22208314205 | | | | 22208314206 | | | |
| **Collected** | 08/23/22 16:20 | | | | 08/23/22 17:10 | | | |
| **Matrix** | Water | | | | Water | | | |
| **Units** | ng/L | | | | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| 11Cl-PF3OUdS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 171 | 7.50U | -171 | 200 | 197 | 7.50U | -197 | 200 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 44.9 | 7.50U | -44.9 | 200 | 40.3 | 7.50U | -40.3 | 200 |
| 9Cl-PF3ONS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| ADONA | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| NEtFOSA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NEtFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NEtFOSE | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSE | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| PFDoS | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| PFHxDA | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| PFODA | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 15.0 | 14.2 | -0.8 | 5.5 | 18.2 | 16.3 | -1.9 | 11 |
| Perfluorobutanoic acid (PFBA) | 46.5 | 172 | 125.5 | 114.9 | 71.1 | 184 | 112.9 | 88.5 |
| Perfluorodecane sulfonic acid (PFDS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 75.5 | 57.8 | -17.7 | 26.6 | 89.4 | 80.5 | -8.9 | 10.5 |
| Perfluoroheptanoic acid (PFHpA) | 141 | 177 | 36 | 22.6 | 181 | 230 | 49 | 23.8 |
| Perfluorohexanesulfonic acid (PFHxS) | 1720 | 1470 | -250 | 15.7 | 1980 | 1810 | -170 | 9 |
| Perfluorohexanoic acid (PFHxA) | 170 | 1800 | 1630 | 165.5 | 233 | 2470 | 2237 | 165.5 |
| Perfluorononanesulfonic acid (PFNS) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 68.8 | 52.7 | -16.1 | 26.5 | 82.2 | 71.2 | -11 | 14.3 |
| Perfluorooctane Sulfonamide (FOSA) | 2.83J | 5.00U | -2.83 | 200 | 5.00U | 5.00U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 13400 | 9450 | -3950 | 34.6 | 15500 | 14100 | -1400 | 9.5 |
| Perfluorooctanoic acid (PFOA) | 231 | 215 | -16 | 7.2 | 294 | 307 | 13 | 4.3 |
| Perfluoropentanesulfonic acid (PFPeS) | 42.5 | 41.9 | -0.6 | 1.4 | 48.6 | 47.1 | -1.5 | 3.1 |
| Perfluoropentanoic acid (PFPeA) | 114 | 468 | 354 | 121.6 | 170 | 536 | 366 | 103.7 |
| Perfluorotetradecanoic acid (PFTA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |

# Top Assay Pre/Post Summary (Continued)

| Client ID | VRTB-L-P7_08232022 | | | | VRTB-L-BB8_08232022 | | | |
|---|---|---|---|---|---|---|---|---|
| LAB ID | 22208314207 | | | | 22208314208 | | | |
| Collected | 08/23/22 18:00 | | | | 08/23/22 18:40 | | | |
| Matrix | Water | | | | Water | | | |
| Units | ng/L | | | | ng/L | | | |
| **PFAS Top Assay QSM B15** | **PRE** | **POST** | **DIFF** | **RPD(%)** | **PRE** | **POST** | **DIFF** | **RPD(%)** |
| 10:2 Fluorotelomer sulfonic acid (10:2 FTS) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| 11Cl-PF3OUdS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| 6:2 Fluorotelomer sulfonic acid (6:2FTS) | 87.7 | 7.50U | -87.7 | 200 | 73.6 | 7.50U | -73.6 | 200 |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | 48.3 | 7.50U | -48.3 | 200 | 20.5 | 7.50U | -20.5 | 200 |
| 9Cl-PF3ONS | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| ADONA | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| NEtFOSA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NEtFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NEtFOSE | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSAA | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| NMeFOSE | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| PFDoS | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| PFHxDA | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| PFODA | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluoro-2-proxypropanoic acid (HFPO-DA) | 10.0U | 10.0U | 0 | 0 | 10.0U | 10.0U | 0 | 0 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorobutanesulfonic acid (PFBS) | 10.5 | 11.7 | 1.2 | 10.8 | 23.7 | 25.5 | 1.8 | 7.3 |
| Perfluorobutanoic acid (PFBA) | 48.3 | 183 | 134.7 | 116.5 | 58.9 | 212 | 153.1 | 113 |
| Perfluorodecane sulfonic acid (PFDS) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorodecanoic acid (PFDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorododecanoic acid (PFDoA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroheptanesulfonic acid (PFHpS) | 70.6 | 58.7 | -11.9 | 18.4 | 68.6 | 63.4 | -5.2 | 7.9 |
| Perfluoroheptanoic acid (PFHpA) | 117 | 148 | 31 | 23.4 | 140 | 183 | 43 | 26.6 |
| Perfluorohexanesulfonic acid (PFHxS) | 928 | 915 | -13 | 1.4 | 1780 | 1810 | 30 | 1.7 |
| Perfluorohexanoic acid (PFHxA) | 128 | 1310 | 1182 | 164.4 | 222 | 2120 | 1898 | 162.1 |
| Perfluorononanesulfonic acid (PFNS) | 8.75U | 8.75U | 0 | 0 | 8.75U | 8.75U | 0 | 0 |
| Perfluorononanoic acid (PFNA) | 57.9 | 49.8 | -8.1 | 15 | 46.4 | 44.8 | -1.6 | 3.5 |
| Perfluorooctane Sulfonamide (FOSA) | 5.00U | 5.00U | 0 | 0 | 5.00U | 5.00U | 0 | 0 |
| Perfluorooctanesulfonic acid (PFOS) | 18700 | 15100 | -3600 | 21.3 | 9090 | 9030 | -60 | 0.7 |
| Perfluorooctanoic acid (PFOA) | 145 | 155 | 10 | 6.7 | 175 | 186 | 11 | 6.1 |
| Perfluoropentanesulfonic acid (PFPeS) | 21.5 | 25.1 | 3.6 | 15.5 | 55.5 | 67.4 | 11.9 | 19.4 |
| Perfluoropentanoic acid (PFPeA) | 122 | 405 | 283 | 107.4 | 159 | 571 | 412 | 112.9 |
| Perfluorotetradecanoic acid (PFTA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluorotridecanoic acid (PFTrDA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |
| Perfluoroundecanoic acid (PFUnA) | 7.50U | 7.50U | 0 | 0 | 7.50U | 7.50U | 0 | 0 |

Chain of Custody

Pace Analytical
www.pacelabs.com

Workorder: XH29054 Workorder Name: ESTCP Vertebrae Owner Received Date: 8/29/2022 Results Requested By: 9/20/2022

| Report To: | Subcontract To: |
|---|---|
| Kathy E. Smith | Project # |
| Pace Analytical | |
| 106 Vantage Point Drive | Pace - Gulf Coast |
| Columbia SC, 29223 | 7979 Innovation Park Drive |
| 803-227-2704 | Baton Rouge, LA 70820 |
| Kathy.Smith@pacelabs.com | |

| Item | Sample ID | Sample Type | Collect Date/Time | Lab ID | Matrix | Preserved Containers | TOP Assay | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|
| 1 | VRTB-L-B1_08232022 | grab | 08/23/2022 @ 1240 | XH29054-010 | Aqueous | | x | 1 |
| 2 | VRTB-L-S2_08232022 | grab | 08/23/2022 @ 1325 | XH29054-011 | Aqueous | | x | 2 |
| 3 | VRTB-L-Y3_08232022 | grab | 08/23/2022 @ 1420 | XH29054-012 | Aqueous | | x | 3 |
| 4 | VRTB-L-G4_08232022 | grab | 08/23/2022 @ 1510 | XH29054-013 | Aqueous | | x | 4 |
| 5 | VRTB-L-M5_08232022 | grab | 08/23/2022 @ 1620 | XH29054-014 | Aqueous | | x | 5 |
| 6 | VRTB-L-06_08232022 | grab | 08/23/2022 @ 1710 | XH29054-015 | Aqueous | | x | 6 |
| 7 | VRTB-L-P7_08232022 | grab | 08/23/2022 @ 1800 | XH29054-016 | Aqueous | | x | 7 |
| 8 | VRTB-L-BB8_08232022 | grab | 08/23/2022 @ 1840 | XH29054-017 | Aqueous | | x | 8 |
| 9 | | | | | | | | |
| 10 | | | | | | | | |

| Transfers | Released By | Date/Time | Reveived By | Date/Time | Comments |
|---|---|---|---|---|---|
| 1 | | | | | 0.3 EDR |
| 2 | | | | | (663) 367-7950 |
| 3 | FedEx | 8/30/22 1800<br>8/31/22 9:27 | | 8/31/22 9:27 | |

| Cooler Temperature on Receipt _____ °C | Custody Seal Y or N | Received on Ice Y or N | Sample Intact Y or N |
|---|---|---|---|

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Friday, June 17, 2016 11:01:34 AM FMT-ALL-C-002rev.00 24Mar2022

Client ID: 4367 - Pace Analytical Services
SDG: 222083142
PM: RWe

# SAMPLE RECEIVING CHECKLIST

| SAMPLE DELIVERY GROUP 222083142 | |
|---|---|
| **Client** **PM** RWe<br>4367 - Pace Analytical Services | **Transport Method**<br>FEDEX |
| **Profile Number**<br>294268 | **Received By**<br>Roberts, George S. |
| **Line Item(s)**<br>4 - Top Assay Water | **Receive Date(s)**<br>08/31/22 |

| CHECKLIST | YES | NO |
|---|---|---|
| Samples received with proper thermal preservation? | ☑ | ☐ |
| Radioactivity is <1600 cpm? If no, record cpm value in notes section. | ☑ | ☐ |
| COC relinquished and complete (including sampleIDs, collect times, and sampler)? | ☑ | ☐ |
| All containers received in good condition and within hold time? | ☑ | ☐ |
| All sample labels and containers received match the chain of custody? | ☑ | ☐ |
| Preservative added to any containers? | ☐ | ☑ |
| If received, was headspace for VOC water containers < 6mm? | ☑ | ☐ |
| Samples collected in containers provided by Pace Gulf Coast? | ☐ | ☑ |

**COOLERS**

| Airbill | Thermometer ID: E42 | Temp °C |
|---|---|---|
| 1663 3467 7950 | | 0.3 |

**DISCREPANCIES**

None

**LAB PRESERVATIONS**

None

**NOTES**

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

Lot Number:**XH26042**

Date Completed:10/18/2022

10/21/2022 2:53 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: XH26042

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples were compliant with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a DoD/DOE accredited laboratory; however, the following analyses are currently not listed on our DoD/DOE scope of accreditation: Drinking Water: pH EPA 150.1, Turbidity EPA 18.01, Metals EPA 200.7 & 200.8, Mercury EPA 245.1, Anions EPA 300.0, Cyanide EPA 335.4, Nitrates EPA 353.2, Orthophosphate & Phosphorus EPA 365.1, EDB/DBCP EPA 504.1, HPC SIMPLATE, Color SM 2120 B-2011, Alkalinity SM 2320 B-2011, Specific Conductance SM 2510 B-2011, Residue-filterable (TDS) SM 2540 C, Calcium Hardness (CaCO2) SM 3500-Ca B-2011, TRC SM 4500 Cl G-2011, pH SM 4500 H=B-2011, E.Coli, Total Coliform; Non-Potable Water: Metals EPA 200.7, Strontium EPA 200.8, Chlorate EPA 300.0, Cyanide EPA 335.4, Phenolics EPA 420.4, 2-Methyl-4,6-Dinitrophenol EPA 625.1, Propane RSK-175, Specific Conductance SM 2510 B-2011, Salinity SM250 B, Residue- total SM 2540 B, Sulfite SM 4500 SO32- B-2011, Amenable Cyanide SM 4500-CN- G-2011, BOD & CBOD SM 5210 B, MBAS SM 5540 C-2011; Solid and Chemical Materials: Boron & Titanium SW-846 6010D, Boron, Molybdenum, & Titanium SW-846 6020B, Alcohols & Glycols SW-846 8015C, Pentachlorophenol SW-846 8151A, Ethyl Acetate, Hexane, & n-Hexane SW-846 8260D, SVOC 1,4-Dioxane, 3&4-Methylphenols, 4-Dimethyl aminoazobenzene, 1,4-Naphthoquinone, 3,5-Dinitroaniline, PETN SW-846 8270E, Amenable Cyanide SW-846 9012B; Boron & Titanium SW-846 6010D, Molybdenum SW-846 6020B, Ethylene Glycol SW-846 8015B, Pentachlorophenol SW-846 8151A, Chloroprene SW-846 8260B, SVOC 1,3,5-Trinitrobenzene, 1,4-Dioxane, 1,4-Naphthoquinone, 1,4-Phenylenediamine, 2,5-Dinitrotoluene, 2,6-Dinitrotoluene, 3-Methylcholanthrene, 4- Aminobiphenyl, 4-Dimethyl aminoazobenzene, 4-Nitroquinoline-1-oxide, 7,12- Dimethylbenzo(a)anthracene, Chlorobenzilate, Diallate, Ethyl methanesulfonate, Isodrin, Isosafrole, Methyl methanesulfonate, n-Nitrosomethylethylamine, n-Nitrosomorpholine, n-Nitrosopiperidine, Piperonyl butoxide, Pronamide, Safrole, 3,5-Dinitroaniline, PETN SW-846 8270E, Oil & Grease SW-846 9071B.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18.

PFAS
For sample XH26042-003 sample matrix prevented full volume from being extracted, precluding method mandated bottle rinse. Elution solvent was aliquoted directly into the reservoir, rinsing the inside. Surrogate recovery may be adversely affected.

The method blank, laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for prep batch 56292 exceeded acceptance criteria for the following analyte: 6:2 FTS EIS. The data has been reported.

The MS/MSD associated with sample XH26042-009 had compounds recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

Surrogate recovery for the following sample was outside control limits: XH26042-001. Re-extraction and/or re-analysis was performed outside of holding time. All data has been reported.

Surrogate recovery for the following samples was outside the upper control limit: XH26042-002, XH26042-006, XH26042-013, XH26042-015. This sample did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: XH26042

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| PFAS by ID SOP | XH26042-001 | 1 | 1H, 1H, 2H, 2H-perfluorodecane | M-03 |
| PFAS by ID SOP | XH26042-001 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-001 | 1 | Perfluoro-1-octanesulfonamide (PFOSA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-001 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| PFAS by ID SOP | XH26042-001 | 1 | Perfluoro-n-decanoic acid (PFDA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 1 | Perfluoro-n-heptanoic acid (PFHpA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-001 | 2 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-001 | 2 | Perfluoro-n-heptanoic acid (PFHpA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 2 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 2 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-001 | 2 | d-MeFOSA | M-03 |
| PFAS by ID SOP | XH26042-001 | 3 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-001 | 3 | Perfluoro-n-butanoic acid (PFBA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 3 | Perfluoro-n-heptanoic acid (PFHpA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 3 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 3 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH26042-001 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-002 | 1 | 1H, 1H, 2H, 2H-perfluorodecane | M-03 |
| PFAS by ID SOP | XH26042-002 | 1 | 1H, 1H, 2H, 2H-perfluorooctane sulfonic | M-03 |
| PFAS by ID SOP | XH26042-002 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-002 | 1 | Perfluoro-1-nonanesulfonic acid (PFNS) | M-03 |
| PFAS by ID SOP | XH26042-002 | 1 | Perfluoro-1-octanesulfonamide (PFOSA) | M-03 |
| PFAS by ID SOP | XH26042-002 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-002 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| PFAS by ID SOP | XH26042-002 | 1 | Perfluoro-n-decanoic acid (PFDA) | M-03 |
| PFAS by ID SOP | XH26042-002 | 1 | Perfluoro-n-heptanoic acid (PFHpA) | M-03 |
| PFAS by ID SOP | XH26042-002 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-002 | 1 | Perfluoro-n-nonanoic acid (PFNA) | M-03 |
| PFAS by ID SOP | XH26042-002 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-002 | 2 | 13C2_8:2FTS | M-03 |
| PFAS by ID SOP | XH26042-003 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-003 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: XH26042

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| PFAS by ID SOP | XH26042-003 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-003 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-003 | 1 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH26042-003 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-003 | 1 | 13C2_8:2FTS | M-03 |
| PFAS by ID SOP | XH26042-004 | 1 | Perfluoro-1-butanesulfonic acid (PFBS) | M-03 |
| PFAS by ID SOP | XH26042-004 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-004 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-004 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-004 | 1 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH26042-004 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-005 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-005 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-005 | 1 | Perfluoro-n-heptanoic acid (PFHpA) | M-03 |
| PFAS by ID SOP | XH26042-005 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-005 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-005 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-006 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-006 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-006 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-006 | 1 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH26042-006 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-006 | 1 | d5-EtFOSAA | M-03 |
| PFAS by ID SOP | XH26042-006 | 1 | d-MeFOSA | M-03 |
| PFAS by ID SOP | XH26042-007 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-007 | 1 | Perfluoro-n-heptanoic acid (PFHpA) | M-03 |
| PFAS by ID SOP | XH26042-007 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-007 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-007 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-008 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-008 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-008 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-008 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-008 | 1 | 13C2_6:2FTS | M-03 |
| PFAS by ID SOP | XH26042-009 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-009 | 1 | Perfluoro-n-heptanoic acid (PFHpA) | M-03 |
| PFAS by ID SOP | XH26042-009 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: XH26042

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| PFAS by ID SOP | XH26042-009 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-009 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-009 | 1 | 13C6_PFDA | M-03 |
| PFAS by ID SOP | XH26042-012 | 1 | 1H,1H,2H,2H-perfluorohexane sulfonic | M-03 |
| PFAS by ID SOP | XH26042-012 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-012 | 1 | Perfluoro-1-octanesulfonamide (PFOSA) | M-03 |
| PFAS by ID SOP | XH26042-012 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-012 | 1 | Perfluoro-n-nonanoic acid (PFNA) | M-03 |
| PFAS by ID SOP | XH26042-012 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-012 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-012 | 2 | 13C2_8:2FTS | M-03 |
| PFAS by ID SOP | XH26042-012 | 2 | 13C8_PFOSA | M-03 |
| PFAS by ID SOP | XH26042-012 | 2 | d-MeFOSA | M-03 |
| PFAS by ID SOP | XH26042-013 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-013 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| PFAS by ID SOP | XH26042-013 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-013 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-013 | 1 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH26042-013 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-014 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-014 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH26042-014 | 1 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH26042-015 | 1 | Perfluoro-1-butanesulfonic acid (PFBS) | M-03 |
| PFAS by ID SOP | XH26042-015 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-015 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-015 | 1 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH26042-015 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XQ54120-001 | 1 | 1H, 1H, 2H, 2H-perfluorooctane sulfonic | M-03 |
| PFAS by ID SOP | XH26042-009MD | 1 | 1H,1H,2H,2H-perfluorohexane sulfonic | M-03 |
| PFAS by ID SOP | XH26042-009MS | 1 | N-ethylperfluoro-1- | M-03 |
| PFAS by ID SOP | XH26042-009MD | 1 | N-ethylperfluoro-1- | M-03 |
| PFAS by ID SOP | XH26042-009MS | 1 | N-methylperfluoro-1-octanesulfonamide | M-03 |
| PFAS by ID SOP | XQ54120-002 | 1 | N-methylperfluoro-1- | M-03 |
| PFAS by ID SOP | XH26042-009MS | 1 | N-methylperfluoro-1- | M-03 |
| PFAS by ID SOP | XH26042-009MD | 1 | N-methylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ54120-001 | 1 | Perfluoro-1-octanesulfonamide (PFOSA) | M-03 |
| PFAS by ID SOP | XH26042-009MD | 1 | Perfluoro-1-octanesulfonamide (PFOSA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: XH26042

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| PFAS by ID SOP | XH26042-009MS | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH26042-009MD | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XQ54120-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| PFAS by ID SOP | XH26042-009MS | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-009MD | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH26042-009MS | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XQ54120-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-009MS | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH26042-009MD | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XQ56292-002 | 1 | 1H, 1H, 2H, 2H-perfluorodecane | M-03 |
| PFAS by ID SOP | XQ56292-001 | 1 | 1H, 1H, 2H, 2H-perfluorooctane sulfonic | M-03 |
| PFAS by ID SOP | XQ56292-002 | 1 | N-ethylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ56292-002 | 1 | N-methylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ56292-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | N-ethylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | N-methylperfluoro-1-octanesulfonamide | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | N-methylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | Perfluoro-1-octanesulfonamide (PFOSA) | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | Perfluoro-n-undecanoic acid (PFUdA) | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XQ54257-002 | 1 | N-methylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ54257-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: XH26042

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | VRTB-S-M5_08242022 | Aqueous | 08/24/2022 1235 | 08/26/2022 |
| 002 | VRTB-S-06_08242022 | Aqueous | 08/24/2022 1355 | 08/26/2022 |
| 003 | VRTB-S-R7_08242022 | Aqueous | 08/24/2022 1450 | 08/26/2022 |
| 004 | VRTB-S-P8_08242022 | Aqueous | 08/24/2022 1600 | 08/26/2022 |
| 005 | MW-VRTB-1S_08242022 | Aqueous | 08/24/2022 1655 | 08/26/2022 |
| 006 | MW-VRTB-1D_08242022 | Aqueous | 08/24/2022 1730 | 08/26/2022 |
| 007 | MW-VRTB-2S_08242022 | Aqueous | 08/24/2022 1815 | 08/26/2022 |
| 008 | MW-VRTB-2D_08242022 | Aqueous | 08/24/2022 1850 | 08/26/2022 |
| 009 | MW-VRTB-3_08242022 | Aqueous | 08/24/2022 1940 | 08/26/2022 |
| 010 | CMT-VRTB-01_2_08252022 | Aqueous | 08/25/2022 0905 | 08/26/2022 |
| 011 | CMT-VRTB-01_3_08252022 | Aqueous | 08/25/2022 0955 | 08/26/2022 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | 08/25/2022 1035 | 08/26/2022 |
| 013 | CMT-VRTB-01_5_08252022 | Aqueous | 08/25/2022 1110 | 08/26/2022 |
| 014 | CMT-VRTB-01_6_08252022 | Aqueous | 08/25/2022 1140 | 08/26/2022 |
| 015 | CMT-VRTB-01_7_08252022 | Aqueous | 08/25/2022 1210 | 08/26/2022 |

(15 samples)

# Detection Summary

## Arcadis U.S., Inc.

Lot Number: XH26042

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | VRTB-S-M5_08242022 | Aqueous | TOC | SM 5310C- | 26 | | mg/L | 13 |
| 001 | VRTB-S-M5_08242022 | Aqueous | 8:2 FTS | PFAS by ID | 8.7 | M-03 | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | 6:2 FTS | PFAS by ID | 12 | | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFBS | PFAS by ID | 4.9 | | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFHpS | PFAS by ID | 15 | M-03 | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFOSA | PFAS by ID | 1.4 | JM-03 | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFPeS | PFAS by ID | 9.1 | M-03 | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFBA | PFAS by ID | 16 | | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFHpA | PFAS by ID | 23 | M-03 | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFHxA | PFAS by ID | 35 | M-03 | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFNA | PFAS by ID | 8.7 | | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFOA | PFAS by ID | 29 | M-03 | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFPeA | PFAS by ID | 25 | | ng/L | 14 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFHxS | PFAS by ID | 280 | | ng/L | 16 |
| 001 | VRTB-S-M5_08242022 | Aqueous | PFOS | PFAS by ID | 2000 | M-03 | ng/L | 16 |
| 002 | VRTB-S-06_08242022 | Aqueous | 8:2 FTS | PFAS by ID | 2.2 | JM-03 | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFBS | PFAS by ID | 4.3 | | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFHpS | PFAS by ID | 27 | M-03 | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFOSA | PFAS by ID | 4.5 | M-03 | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFPeS | PFAS by ID | 9.2 | M-03 | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFHxS | PFAS by ID | 250 | M-03 | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFBA | PFAS by ID | 10 | | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFHpA | PFAS by ID | 14 | M-03 | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFHxA | PFAS by ID | 16 | M-03 | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFNA | PFAS by ID | 7.5 | M-03 | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFOA | PFAS by ID | 28 | | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFPeA | PFAS by ID | 7.2 | | ng/L | 20 |
| 002 | VRTB-S-06_08242022 | Aqueous | PFOS | PFAS by ID | 1800 | M-03 | ng/L | 20 |
| 003 | VRTB-S-R7_08242022 | Aqueous | TOC | SM 5310C- | 28 | | mg/L | 22 |
| 003 | VRTB-S-R7_08242022 | Aqueous | PFHpS | PFAS by ID | 130 | JM-03 | ng/L | 23 |
| 003 | VRTB-S-R7_08242022 | Aqueous | PFHxS | PFAS by ID | 2100 | | ng/L | 23 |
| 003 | VRTB-S-R7_08242022 | Aqueous | PFHpA | PFAS by ID | 140 | J | ng/L | 23 |
| 003 | VRTB-S-R7_08242022 | Aqueous | PFHxA | PFAS by ID | 260 | JM-03 | ng/L | 23 |
| 003 | VRTB-S-R7_08242022 | Aqueous | PFOA | PFAS by ID | 260 | JM-03 | ng/L | 23 |
| 003 | VRTB-S-R7_08242022 | Aqueous | PFOS | PFAS by ID | 23000 | M-03 | ng/L | 23 |
| 004 | VRTB-S-P8_08242022 | Aqueous | PFHxS | PFAS by ID | 1400 | | ng/L | 25 |
| 004 | VRTB-S-P8_08242022 | Aqueous | PFHxA | PFAS by ID | 140 | JM-03 | ng/L | 25 |
| 004 | VRTB-S-P8_08242022 | Aqueous | PFOA | PFAS by ID | 150 | JM-03 | ng/L | 25 |
| 004 | VRTB-S-P8_08242022 | Aqueous | PFOS | PFAS by ID | 13000 | M-03 | ng/L | 25 |
| 005 | MW-VRTB-1S_08242022 | Aqueous | PFHpS | PFAS by ID | 110 | JM-03 | ng/L | 27 |
| 005 | MW-VRTB-1S_08242022 | Aqueous | PFHxS | PFAS by ID | 1800 | | ng/L | 27 |
| 005 | MW-VRTB-1S_08242022 | Aqueous | PFHpA | PFAS by ID | 150 | JM-03 | ng/L | 27 |
| 005 | MW-VRTB-1S_08242022 | Aqueous | PFHxA | PFAS by ID | 170 | JM-03 | ng/L | 27 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 005 | MW-VRTB-1S_08242022 | Aqueous | PFOA | PFAS by ID | 370 | M-03 | ng/L | 27 |
| 005 | MW-VRTB-1S_08242022 | Aqueous | PFPeA | PFAS by ID | 160 | J | ng/L | 27 |
| 005 | MW-VRTB-1S_08242022 | Aqueous | PFOS | PFAS by ID | 17000 | M-03 | ng/L | 27 |
| 006 | MW-VRTB-1D_08242022 | Aqueous | PFBS | PFAS by ID | 7.0 | | ng/L | 29 |
| 006 | MW-VRTB-1D_08242022 | Aqueous | PFHpS | PFAS by ID | 4.9 | | ng/L | 29 |
| 006 | MW-VRTB-1D_08242022 | Aqueous | PFPeS | PFAS by ID | 9.2 | M-03 | ng/L | 29 |
| 006 | MW-VRTB-1D_08242022 | Aqueous | PFHxS | PFAS by ID | 140 | | ng/L | 29 |
| 006 | MW-VRTB-1D_08242022 | Aqueous | PFBA | PFAS by ID | 10 | | ng/L | 29 |
| 006 | MW-VRTB-1D_08242022 | Aqueous | PFHpA | PFAS by ID | 9.9 | | ng/L | 29 |
| 006 | MW-VRTB-1D_08242022 | Aqueous | PFHxA | PFAS by ID | 14 | M-03 | ng/L | 29 |
| 006 | MW-VRTB-1D_08242022 | Aqueous | PFOA | PFAS by ID | 14 | M-03 | ng/L | 29 |
| 006 | MW-VRTB-1D_08242022 | Aqueous | PFPeA | PFAS by ID | 14 | M-03 | ng/L | 29 |
| 006 | MW-VRTB-1D_08242022 | Aqueous | PFOS | PFAS by ID | 170 | M-03 | ng/L | 29 |
| 007 | MW-VRTB-2S_08242022 | Aqueous | PFHxS | PFAS by ID | 610 | | ng/L | 31 |
| 007 | MW-VRTB-2S_08242022 | Aqueous | PFHpA | PFAS by ID | 110 | JM-03 | ng/L | 31 |
| 007 | MW-VRTB-2S_08242022 | Aqueous | PFHxA | PFAS by ID | 100 | JM-03 | ng/L | 31 |
| 007 | MW-VRTB-2S_08242022 | Aqueous | PFOA | PFAS by ID | 150 | JM-03 | ng/L | 31 |
| 007 | MW-VRTB-2S_08242022 | Aqueous | PFPeA | PFAS by ID | 110 | J | ng/L | 31 |
| 007 | MW-VRTB-2S_08242022 | Aqueous | PFOS | PFAS by ID | 8600 | M-03 | ng/L | 31 |
| 008 | MW-VRTB-2D_08242022 | Aqueous | PFBS | PFAS by ID | 9.0 | J | ng/L | 33 |
| 008 | MW-VRTB-2D_08242022 | Aqueous | PFHpS | PFAS by ID | 12 | JM-03 | ng/L | 33 |
| 008 | MW-VRTB-2D_08242022 | Aqueous | PFPeS | PFAS by ID | 13 | JM-03 | ng/L | 33 |
| 008 | MW-VRTB-2D_08242022 | Aqueous | PFHxS | PFAS by ID | 240 | | ng/L | 33 |
| 008 | MW-VRTB-2D_08242022 | Aqueous | PFBA | PFAS by ID | 18 | | ng/L | 33 |
| 008 | MW-VRTB-2D_08242022 | Aqueous | PFHpA | PFAS by ID | 11 | J | ng/L | 33 |
| 008 | MW-VRTB-2D_08242022 | Aqueous | PFHxA | PFAS by ID | 29 | | ng/L | 33 |
| 008 | MW-VRTB-2D_08242022 | Aqueous | PFOA | PFAS by ID | 47 | M-03 | ng/L | 33 |
| 008 | MW-VRTB-2D_08242022 | Aqueous | PFPeA | PFAS by ID | 30 | | ng/L | 33 |
| 008 | MW-VRTB-2D_08242022 | Aqueous | PFOS | PFAS by ID | 380 | M-03 | ng/L | 33 |
| 009 | MW-VRTB-3_08242022 | Aqueous | PFHpS | PFAS by ID | 7.6 | J | ng/L | 35 |
| 009 | MW-VRTB-3_08242022 | Aqueous | PFPeS | PFAS by ID | 5.0 | JM-03 | ng/L | 35 |
| 009 | MW-VRTB-3_08242022 | Aqueous | PFHxS | PFAS by ID | 150 | S | ng/L | 35 |
| 009 | MW-VRTB-3_08242022 | Aqueous | PFBA | PFAS by ID | 18 | | ng/L | 35 |
| 009 | MW-VRTB-3_08242022 | Aqueous | PFHpA | PFAS by ID | 9.4 | JM-03 | ng/L | 35 |
| 009 | MW-VRTB-3_08242022 | Aqueous | PFHxA | PFAS by ID | 26 | SM-03 | ng/L | 35 |
| 009 | MW-VRTB-3_08242022 | Aqueous | PFNA | PFAS by ID | 6.8 | J | ng/L | 35 |
| 009 | MW-VRTB-3_08242022 | Aqueous | PFOA | PFAS by ID | 22 | SM-03 | ng/L | 35 |
| 009 | MW-VRTB-3_08242022 | Aqueous | PFPeA | PFAS by ID | 22 | S | ng/L | 35 |
| 009 | MW-VRTB-3_08242022 | Aqueous | PFOS | PFAS by ID | 580 | SM-03 | ng/L | 35 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | 8:2 FTS | PFAS by ID | 220 | | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | 6:2 FTS | PFAS by ID | 1100 | | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | 4:2 FTS | PFAS by ID | 4.9 | JM-03 | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFBS | PFAS by ID | 23 | | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFHpS | PFAS by ID | 9.5 | M-03 | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFPeS | PFAS by ID | 19 | M-03 | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFHxS | PFAS by ID | 520 | | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFBA | PFAS by ID | 250 | | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFDA | PFAS by ID | 8.3 | | ng/L | 37 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFHpA | PFAS by ID | 260 | | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFHxA | PFAS by ID | 660 | | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFNA | PFAS by ID | 25 | M-03 | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFOA | PFAS by ID | 170 | M-03 | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFPeA | PFAS by ID | 1000 | | ng/L | 37 |
| 012 | CMT-VRTB-01_4_08252022 | Aqueous | PFOS | PFAS by ID | 620 | M-03 | ng/L | 37 |
| 013 | CMT-VRTB-01_5_08252022 | Aqueous | PFBS | PFAS by ID | 9.8 | | ng/L | 39 |
| 013 | CMT-VRTB-01_5_08252022 | Aqueous | PFPeS | PFAS by ID | 2.3 | JM-03 | ng/L | 39 |
| 013 | CMT-VRTB-01_5_08252022 | Aqueous | PFHxS | PFAS by ID | 48 | M-03 | ng/L | 39 |
| 013 | CMT-VRTB-01_5_08252022 | Aqueous | PFBA | PFAS by ID | 11 | | ng/L | 39 |
| 013 | CMT-VRTB-01_5_08252022 | Aqueous | PFHpA | PFAS by ID | 2.5 | J | ng/L | 39 |
| 013 | CMT-VRTB-01_5_08252022 | Aqueous | PFHxA | PFAS by ID | 3.6 | M-03 | ng/L | 39 |
| 013 | CMT-VRTB-01_5_08252022 | Aqueous | PFNA | PFAS by ID | 1.4 | J | ng/L | 39 |
| 013 | CMT-VRTB-01_5_08252022 | Aqueous | PFOA | PFAS by ID | 11 | M-03 | ng/L | 39 |
| 013 | CMT-VRTB-01_5_08252022 | Aqueous | PFPeA | PFAS by ID | 4.5 | M-03 | ng/L | 39 |
| 013 | CMT-VRTB-01_5_08252022 | Aqueous | PFOS | PFAS by ID | 32 | M-03 | ng/L | 39 |
| 014 | CMT-VRTB-01_6_08252022 | Aqueous | PFBS | PFAS by ID | 9.3 | | ng/L | 41 |
| 014 | CMT-VRTB-01_6_08252022 | Aqueous | PFHpS | PFAS by ID | 6.6 | | ng/L | 41 |
| 014 | CMT-VRTB-01_6_08252022 | Aqueous | PFPeS | PFAS by ID | 12 | | ng/L | 41 |
| 014 | CMT-VRTB-01_6_08252022 | Aqueous | PFHxS | PFAS by ID | 190 | | ng/L | 41 |
| 014 | CMT-VRTB-01_6_08252022 | Aqueous | PFBA | PFAS by ID | 12 | | ng/L | 41 |
| 014 | CMT-VRTB-01_6_08252022 | Aqueous | PFHpA | PFAS by ID | 12 | | ng/L | 41 |
| 014 | CMT-VRTB-01_6_08252022 | Aqueous | PFHxA | PFAS by ID | 23 | M-03 | ng/L | 41 |
| 014 | CMT-VRTB-01_6_08252022 | Aqueous | PFOA | PFAS by ID | 16 | M-03 | ng/L | 41 |
| 014 | CMT-VRTB-01_6_08252022 | Aqueous | PFPeA | PFAS by ID | 14 | M-03 | ng/L | 41 |
| 014 | CMT-VRTB-01_6_08252022 | Aqueous | PFOS | PFAS by ID | 140 | | ng/L | 41 |
| 015 | CMT-VRTB-01_7_08252022 | Aqueous | PFBS | PFAS by ID | 2.1 | JM-03 | ng/L | 43 |
| 015 | CMT-VRTB-01_7_08252022 | Aqueous | PFHpS | PFAS by ID | 0.92 | J | ng/L | 43 |
| 015 | CMT-VRTB-01_7_08252022 | Aqueous | PFPeS | PFAS by ID | 2.8 | JM-03 | ng/L | 43 |
| 015 | CMT-VRTB-01_7_08252022 | Aqueous | PFHxS | PFAS by ID | 28 | | ng/L | 43 |
| 015 | CMT-VRTB-01_7_08252022 | Aqueous | PFBA | PFAS by ID | 4.3 | | ng/L | 43 |
| 015 | CMT-VRTB-01_7_08252022 | Aqueous | PFHxA | PFAS by ID | 2.4 | JM-03 | ng/L | 43 |
| 015 | CMT-VRTB-01_7_08252022 | Aqueous | PFOA | PFAS by ID | 1.7 | J | ng/L | 43 |
| 015 | CMT-VRTB-01_7_08252022 | Aqueous | PFPeA | PFAS by ID | 1.7 | JM-03 | ng/L | 43 |
| 015 | CMT-VRTB-01_7_08252022 | Aqueous | PFOS | PFAS by ID | 16 | M-03 | ng/L | 43 |

(126 detections)

# Inorganic non-metals

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-001
Description: VRTB-S-M5_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1235 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | | (TOC) SM 5310C-2014 | 1 | 09/03/2022 1339 | CMM | | 53178 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| TOC | | SM 5310C-2014 | 26 | | 2.0 | 1.5 | 0.60 | mg/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-001
Description: VRTB-S-M5_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1235 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 2240 | MMM | 09/14/2022 1016 | 54120 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 09/30/2022 1849 | ALM | 09/14/2022 1016 | 54120 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2022 1833 | BWS | 10/06/2022 1957 | 56292 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 8.7 | M-03 | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 12 | | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.9 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 15 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.4 | JM-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 9.1 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 290 | EM-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 16 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UM-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 23 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 35 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 8.7 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 29 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 25 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2300 | EM-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 162 | 50-150 | | 123 | 50-150 | H | 128 | 50-150 |
| 13C2_6:2FTS | | 138 | 50-150 | | 114 | 50-150 | HN | 169 | 50-150 |
| 13C2_8:2FTS | | 132 | 50-150 | | 107 | 50-150 | H | 108 | 50-150 |
| 13C2_PFDoA | | 78 | 50-150 | | 70 | 50-150 | H | 73 | 50-150 |
| 13C2_PFTeDA | N | 45 | 50-150 | N | 40 | 50-150 | H | 55 | 50-150 |
| 13C3_PFBS | | 127 | 50-150 | | 118 | 50-150 | H | 96 | 50-150 |
| 13C3_PFHxS | | 126 | 50-150 | | 118 | 50-150 | H | 90 | 50-150 |
| 13C4_PFBA | | 109 | 50-150 | | 105 | 50-150 | H | 89 | 50-150 |
| 13C4_PFHpA | | 131 | 50-150 | | 105 | 50-150 | H | 95 | 50-150 |
| 13C5_PFHxA | | 132 | 50-150 | | 108 | 50-150 | H | 93 | 50-150 |
| 13C5_PFPeA | | 122 | 50-150 | | 114 | 50-150 | H | 98 | 50-150 |
| 13C6_PFDA | | 121 | 50-150 | | 95 | 50-150 | H | 95 | 50-150 |
| 13C7_PFUdA | | 104 | 50-150 | | 96 | 50-150 | H | 86 | 50-150 |
| 13C8_PFOA | | 129 | 50-150 | | 114 | 50-150 | H | 91 | 50-150 |
| 13C8_PFOS | | 110 | 50-150 | | 113 | 50-150 | H | 76 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH26042-001
Description: VRTB-S-M5_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 1235
Project Name: ESTCP Vertebrae
Date Received: 08/26/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 123 | 50-150 | | 103 | 50-150 | H | 98 | 50-150 |
| 13C9_PFNA | | 117 | 50-150 | | 104 | 50-150 | H | 79 | 50-150 |
| d5-EtFOSAA | | 104 | 50-150 | | 89 | 50-150 | H | 95 | 50-150 |
| d-MeFOSA | | 76 | 50-150 | M-03 | 70 | 50-150 | H | 75 | 50-150 |
| d3-MeFOSAA | | 119 | 50-150 | | 97 | 50-150 | H | 96 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-001
Description: VRTB-S-M5_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1235 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 2240 | MMM | 09/14/2022 1016 | 54120 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 09/30/2022 1849 | ALM | 09/14/2022 1016 | 54120 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2022 1833 | BWS | 10/06/2022 1957 | 56292 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 70 | U | 140 | 70 | 34 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 13 | J | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 17 | UM-03 | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 280 | | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 15 | J | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 21 | JM-03 | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 35 | | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 8.9 | J | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 32 | JM-03 | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 24 | JM-03 | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 17 | UQ | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2000 | M-03 | 34 | 17 | 8.6 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 162 | 50-150 | | 123 | 50-150 | H | 128 | 50-150 |
| 13C2_6:2FTS | | 138 | 50-150 | | 114 | 50-150 | HN | 169 | 50-150 |
| 13C2_8:2FTS | | 132 | 50-150 | | 107 | 50-150 | H | 108 | 50-150 |
| 13C2_PFDoA | | 78 | 50-150 | | 70 | 50-150 | H | 73 | 50-150 |
| 13C2_PFTeDA | N | 45 | 50-150 | N | 40 | 50-150 | H | 55 | 50-150 |
| 13C3_PFBS | | 127 | 50-150 | | 118 | 50-150 | H | 96 | 50-150 |
| 13C3_PFHxS | | 126 | 50-150 | | 118 | 50-150 | H | 90 | 50-150 |
| 13C4_PFBA | | 109 | 50-150 | | 105 | 50-150 | H | 89 | 50-150 |
| 13C4_PFHpA | | 131 | 50-150 | | 105 | 50-150 | H | 95 | 50-150 |
| 13C5_PFHxA | | 132 | 50-150 | | 108 | 50-150 | H | 93 | 50-150 |
| 13C5_PFPeA | | 122 | 50-150 | | 114 | 50-150 | H | 98 | 50-150 |
| 13C6_PFDA | | 121 | 50-150 | | 95 | 50-150 | H | 95 | 50-150 |
| 13C7_PFUdA | | 104 | 50-150 | | 96 | 50-150 | H | 86 | 50-150 |
| 13C8_PFOA | | 129 | 50-150 | | 114 | 50-150 | H | 91 | 50-150 |
| 13C8_PFOS | | 110 | 50-150 | | 113 | 50-150 | H | 76 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH26042-001
Description: VRTB-S-M5_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 1235
Project Name: ESTCP Vertebrae
Date Received: 08/26/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 123 | 50-150 | | 103 | 50-150 | H | 98 | 50-150 |
| 13C9_PFNA | | 117 | 50-150 | | 104 | 50-150 | H | 79 | 50-150 |
| d5-EtFOSAA | | 104 | 50-150 | | 89 | 50-150 | H | 95 | 50-150 |
| d-MeFOSA | | 76 | 50-150 | M-03 | 70 | 50-150 | H | 75 | 50-150 |
| d3-MeFOSAA | | 119 | 50-150 | | 97 | 50-150 | H | 96 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-001
Description: VRTB-S-M5_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1235 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 2240 | MMM | 09/14/2022 1016 | 54120 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 09/30/2022 1849 | ALM | 09/14/2022 1016 | 54120 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2022 1833 | BWS | 10/06/2022 1957 | 56292 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 5.5 | HJ | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 11 | HQ | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | UH | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | UH | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.5 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | UH | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.7 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 15 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.6 | HJ | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 8.8 | HM-03 | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 280 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 15 | HM-03 | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 22 | HM-03 | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 36 | HM-03 | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 8.9 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 28 | H | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 25 | HM-03 | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.87 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 2400 | HEM-03 | 3.5 | 1.8 | 0.87 | ng/L | 3 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 162 | 50-150 | | 123 | 50-150 | H | 128 | 50-150 |
| 13C2_6:2FTS | | 138 | 50-150 | | 114 | 50-150 | HN | 169 | 50-150 |
| 13C2_8:2FTS | | 132 | 50-150 | | 107 | 50-150 | H | 108 | 50-150 |
| 13C2_PFDoA | | 78 | 50-150 | | 70 | 50-150 | H | 73 | 50-150 |
| 13C2_PFTeDA | N | 45 | 50-150 | N | 40 | 50-150 | H | 55 | 50-150 |
| 13C3_PFBS | | 127 | 50-150 | | 118 | 50-150 | H | 96 | 50-150 |
| 13C3_PFHxS | | 126 | 50-150 | | 118 | 50-150 | H | 90 | 50-150 |
| 13C4_PFBA | | 109 | 50-150 | | 105 | 50-150 | H | 89 | 50-150 |
| 13C4_PFHpA | | 131 | 50-150 | | 105 | 50-150 | H | 95 | 50-150 |
| 13C5_PFHxA | | 132 | 50-150 | | 108 | 50-150 | H | 93 | 50-150 |
| 13C5_PFPeA | | 122 | 50-150 | | 114 | 50-150 | H | 98 | 50-150 |
| 13C6_PFDA | | 121 | 50-150 | | 95 | 50-150 | H | 95 | 50-150 |
| 13C7_PFUdA | | 104 | 50-150 | | 96 | 50-150 | H | 86 | 50-150 |
| 13C8_PFOA | | 129 | 50-150 | | 114 | 50-150 | H | 91 | 50-150 |
| 13C8_PFOS | | 110 | 50-150 | | 113 | 50-150 | H | 76 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH26042-001
Description: VRTB-S-M5_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 1235
Project Name: ESTCP Vertebrae
Date Received: 08/26/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 123 | 50-150 | | 103 | 50-150 | H | 98 | 50-150 |
| 13C9_PFNA | | 117 | 50-150 | | 104 | 50-150 | H | 79 | 50-150 |
| d5-EtFOSAA | | 104 | 50-150 | | 89 | 50-150 | H | 95 | 50-150 |
| d-MeFOSA | | 76 | 50-150 | M-03 | 70 | 50-150 | H | 75 | 50-150 |
| d3-MeFOSAA | | 119 | 50-150 | | 97 | 50-150 | H | 96 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-002
Description: VRTB-S-06_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1355 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 2253 | MMM | 09/14/2022 1016 | 54120 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 10 | 09/30/2022 1921 | ALM | 09/14/2022 1016 | 54120 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 2.2 | JM-03 | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UM-03 | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.3 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 27 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UM-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 4.5 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 9.2 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 250 | M-03 | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 10 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | UM-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 14 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 16 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.5 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 28 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 7.2 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1800 | M-03 | 35 | 18 | 8.7 | ng/L | 2 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 151 | 50-150 | | 120 | 50-150 |
| 13C2_6:2FTS | | 136 | 50-150 | | 123 | 50-150 |
| 13C2_8:2FTS | | 131 | 50-150 | M-03 | 100 | 50-150 |
| 13C2_PFDoA | | 91 | 50-150 | | 79 | 50-150 |
| 13C2_PFTeDA | | 69 | 50-150 | | 62 | 50-150 |
| 13C3_PFBS | | 128 | 50-150 | | 113 | 50-150 |
| 13C3_PFHxS | | 126 | 50-150 | | 113 | 50-150 |
| 13C4_PFBA | | 120 | 50-150 | | 106 | 50-150 |
| 13C4_PFHpA | | 128 | 50-150 | | 110 | 50-150 |
| 13C5_PFHxA | | 132 | 50-150 | | 115 | 50-150 |
| 13C5_PFPeA | | 122 | 50-150 | | 114 | 50-150 |
| 13C6_PFDA | | 122 | 50-150 | | 88 | 50-150 |
| 13C7_PFUdA | | 69 | 50-150 | | 97 | 50-150 |
| 13C8_PFOA | | 128 | 50-150 | | 110 | 50-150 |
| 13C8_PFOS | | 116 | 50-150 | | 103 | 50-150 |
| 13C8_PFOSA | | 120 | 50-150 | | 109 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH26042-002
Description: VRTB-S-06_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 1355
Project Name: ESTCP Vertebrae
Date Received: 08/26/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 123 | 50-150 | | 113 | 50-150 |
| d5-EtFOSAA | | 62 | 50-150 | | 93 | 50-150 |
| d-MeFOSA | | 81 | 50-150 | | 85 | 50-150 |
| d3-MeFOSAA | | 115 | 50-150 | | 94 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# Inorganic non-metals

Client: Arcadis U.S., Inc.
Laboratory ID: XH26042-003
Description: VRTB-S-R7_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 1450
Project Name: ESTCP Vertebrae
Date Received: 08/26/2022
Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | | (TOC) SM 5310C-2014 | 1 | 09/03/2022 1412 | CMM | | 53178 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| TOC | | SM 5310C-2014 | 28 | | 2.0 | 1.5 | 0.60 | mg/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-003
Description: VRTB-S-R7_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1450 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 09/30/2022 1517 | ALM | 09/14/2022 1016 | 54120 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 500 | U | 1000 | 500 | 250 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 500 | U | 1000 | 500 | 250 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 500 | U | 1000 | 500 | 250 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 500 | U | 1000 | 500 | 250 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 1000 | U | 2000 | 1000 | 500 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 500 | U | 1000 | 500 | 250 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 250 | U | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 250 | U | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 130 | JM-03 | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 250 | U | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 250 | U | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 250 | UM-03 | 500 | 250 | 130 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 2100 | | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 250 | U | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 250 | U | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 250 | U | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 140 | J | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 260 | JM-03 | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 250 | U | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 260 | JM-03 | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 250 | UM-03 | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 250 | U | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 250 | U | 500 | 250 | 130 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 250 | U | 500 | 250 | 130 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 23000 | M-03 | 500 | 250 | 130 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 130 | 50-150 |
| 13C2_6:2FTS | | 125 | 50-150 |
| 13C2_8:2FTS | M-03 | 120 | 50-150 |
| 13C2_PFDoA | | 135 | 50-150 |
| 13C2_PFTeDA | | 125 | 50-150 |
| 13C3_PFBS | | 113 | 50-150 |
| 13C3_PFHxS | | 124 | 50-150 |
| 13C4_PFBA | | 123 | 50-150 |
| 13C4_PFHpA | | 125 | 50-150 |
| 13C5_PFHxA | | 118 | 50-150 |
| 13C5_PFPeA | | 129 | 50-150 |
| 13C6_PFDA | | 121 | 50-150 |
| 13C7_PFUdA | | 131 | 50-150 |
| 13C8_PFOA | | 130 | 50-150 |
| 13C8_PFOS | | 119 | 50-150 |
| 13C8_PFOSA | | 125 | 50-150 |
| 13C9_PFNA | | 126 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XH26042-003 |
| Description: VRTB-S-R7_08242022 | | | Matrix: Aqueous |
| Date Sampled: 08/24/2022 1450 | | Project Name: ESTCP Vertebrae | |
| Date Received: 08/26/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 125 | 50-150 |
| d-MeFOSA | | 133 | 50-150 |
| d3-MeFOSAA | | 133 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-004
Description: VRTB-S-P8_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1600 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 09/30/2022 1527 | ALM | 09/14/2022 1016 | 54120 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 350 | U | 690 | 350 | 170 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 350 | U | 690 | 350 | 170 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 350 | U | 690 | 350 | 170 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 350 | U | 690 | 350 | 170 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 700 | U | 1400 | 700 | 340 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 350 | U | 690 | 350 | 170 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 170 | UM-03 | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 170 | UM-03 | 340 | 170 | 86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1400 | | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 140 | JM-03 | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 150 | JM-03 | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 170 | UM-03 | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 13000 | M-03 | 340 | 170 | 86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 122 | 50-150 |
| 13C2_6:2FTS | | 115 | 50-150 |
| 13C2_8:2FTS | | 129 | 50-150 |
| 13C2_PFDoA | | 120 | 50-150 |
| 13C2_PFTeDA | | 112 | 50-150 |
| 13C3_PFBS | | 123 | 50-150 |
| 13C3_PFHxS | | 124 | 50-150 |
| 13C4_PFBA | | 117 | 50-150 |
| 13C4_PFHpA | | 121 | 50-150 |
| 13C5_PFHxA | | 110 | 50-150 |
| 13C5_PFPeA | | 121 | 50-150 |
| 13C6_PFDA | | 104 | 50-150 |
| 13C7_PFUdA | | 113 | 50-150 |
| 13C8_PFOA | | 119 | 50-150 |
| 13C8_PFOS | | 111 | 50-150 |
| 13C8_PFOSA | | 119 | 50-150 |
| 13C9_PFNA | | 118 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | Laboratory ID: XH26042-004 | |
| Description: VRTB-S-P8_08242022 | | Matrix: Aqueous | |
| Date Sampled: 08/24/2022 1600 | Project Name: ESTCP Vertebrae | | |
| Date Received: 08/26/2022 | Project Number: 30027244.00003 | | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 117 | 50-150 |
| d-MeFOSA | | 129 | 50-150 |
| d3-MeFOSAA | | 126 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-005
Description: MW-VRTB-1S_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1655 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 09/30/2022 1538 | ALM | 09/14/2022 1016 | 54120 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 350 | U | 700 | 350 | 180 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 350 | U | 700 | 350 | 180 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 350 | U | 700 | 350 | 180 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 350 | U | 700 | 350 | 180 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 700 | U | 1400 | 700 | 350 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 350 | U | 700 | 350 | 180 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 180 | U | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 180 | U | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 110 | JM-03 | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 180 | U | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 180 | U | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 180 | UM-03 | 350 | 180 | 88 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 1800 | | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 180 | U | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 180 | U | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 180 | U | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 150 | JM-03 | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 170 | JM-03 | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 180 | U | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 370 | M-03 | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 160 | J | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 180 | U | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 180 | U | 350 | 180 | 88 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 180 | U | 350 | 180 | 88 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 17000 | M-03 | 350 | 180 | 88 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 120 | 50-150 |
| 13C2_6:2FTS | | 114 | 50-150 |
| 13C2_8:2FTS | | 119 | 50-150 |
| 13C2_PFDoA | | 122 | 50-150 |
| 13C2_PFTeDA | | 117 | 50-150 |
| 13C3_PFBS | | 120 | 50-150 |
| 13C3_PFHxS | | 124 | 50-150 |
| 13C4_PFBA | | 115 | 50-150 |
| 13C4_PFHpA | | 111 | 50-150 |
| 13C5_PFHxA | | 115 | 50-150 |
| 13C5_PFPeA | | 111 | 50-150 |
| 13C6_PFDA | | 109 | 50-150 |
| 13C7_PFUdA | | 117 | 50-150 |
| 13C8_PFOA | | 116 | 50-150 |
| 13C8_PFOS | | 116 | 50-150 |
| 13C8_PFOSA | | 115 | 50-150 |
| 13C9_PFNA | | 115 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XH26042-005 |
| Description: MW-VRTB-1S_08242022 | | | Matrix: Aqueous |
| Date Sampled: 08/24/2022 1655 | | Project Name: ESTCP Vertebrae | |
| Date Received: 08/26/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 121 | 50-150 |
| d-MeFOSA | | 120 | 50-150 |
| d3-MeFOSAA | | 122 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-006
Description: MW-VRTB-1D_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1730 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/30/2022 1548 | ALM | 09/14/2022 1016 | 54120 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 7.0 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 4.9 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 9.2 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 140 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 10 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 9.9 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 14 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 14 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 14 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 170 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 102 | 50-150 |
| 13C2_6:2FTS | N | 213 | 50-150 |
| 13C2_8:2FTS | | 107 | 50-150 |
| 13C2_PFDoA | | 100 | 50-150 |
| 13C2_PFTeDA | | 90 | 50-150 |
| 13C3_PFBS | | 113 | 50-150 |
| 13C3_PFHxS | | 109 | 50-150 |
| 13C4_PFBA | | 110 | 50-150 |
| 13C4_PFHpA | | 106 | 50-150 |
| 13C5_PFHxA | | 110 | 50-150 |
| 13C5_PFPeA | | 110 | 50-150 |
| 13C6_PFDA | | 94 | 50-150 |
| 13C7_PFUdA | | 108 | 50-150 |
| 13C8_PFOA | | 117 | 50-150 |
| 13C8_PFOS | | 104 | 50-150 |
| 13C8_PFOSA | | 109 | 50-150 |
| 13C9_PFNA | | 109 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XH26042-006 |
| Description: MW-VRTB-1D_08242022 | | | Matrix: Aqueous |
| Date Sampled: 08/24/2022 1730 | | Project Name: ESTCP Vertebrae | |
| Date Received: 08/26/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | M-03 | 88 | 50-150 |
| d-MeFOSA | M-03 | 88 | 50-150 |
| d3-MeFOSAA | | 103 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-007
Description: MW-VRTB-2S_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1815 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 100 | 09/30/2022 1559 | ALM | 09/14/2022 1016 | 54120 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 700 | U | 1400 | 700 | 340 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 340 | U | 680 | 340 | 170 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 170 | UM-03 | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 610 | | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 110 | JM-03 | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 100 | JM-03 | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 150 | JM-03 | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 110 | J | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 170 | U | 340 | 170 | 85 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 8600 | M-03 | 340 | 170 | 85 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 104 | 50-150 |
| 13C2_6:2FTS | | 105 | 50-150 |
| 13C2_8:2FTS | | 107 | 50-150 |
| 13C2_PFDoA | | 100 | 50-150 |
| 13C2_PFTeDA | | 100 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 |
| 13C3_PFHxS | | 107 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 |
| 13C4_PFHpA | | 108 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 100 | 50-150 |
| 13C6_PFDA | | 95 | 50-150 |
| 13C7_PFUdA | | 104 | 50-150 |
| 13C8_PFOA | | 108 | 50-150 |
| 13C8_PFOS | | 104 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 105 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XH26042-007 |
| Description: MW-VRTB-2S_08242022 | | | Matrix: Aqueous |
| Date Sampled: 08/24/2022 1815 | | Project Name: ESTCP Vertebrae | |
| Date Received: 08/26/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 104 | 50-150 |
| d-MeFOSA | | 118 | 50-150 |
| d3-MeFOSAA | | 109 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-008
Description: MW-VRTB-2D_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1850 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 09/30/2022 1610 | ALM | 09/14/2022 1016 | 54120 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.0 | J | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 12 | JM-03 | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 13 | JM-03 | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 240 | | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 18 | | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 11 | J | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 29 | | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 47 | M-03 | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 30 | | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 380 | M-03 | 17 | 8.5 | 4.3 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 115 | 50-150 |
| 13C2_6:2FTS | M-03 | 114 | 50-150 |
| 13C2_8:2FTS | | 95 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 |
| 13C2_PFTeDA | | 76 | 50-150 |
| 13C3_PFBS | | 118 | 50-150 |
| 13C3_PFHxS | | 110 | 50-150 |
| 13C4_PFBA | | 108 | 50-150 |
| 13C4_PFHpA | | 119 | 50-150 |
| 13C5_PFHxA | | 112 | 50-150 |
| 13C5_PFPeA | | 107 | 50-150 |
| 13C6_PFDA | | 99 | 50-150 |
| 13C7_PFUdA | | 92 | 50-150 |
| 13C8_PFOA | | 103 | 50-150 |
| 13C8_PFOS | | 98 | 50-150 |
| 13C8_PFOSA | | 104 | 50-150 |
| 13C9_PFNA | | 106 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XH26042-008 |
| Description: MW-VRTB-2D_08242022 | | | Matrix: Aqueous |
| Date Sampled: 08/24/2022 1850 | | Project Name: ESTCP Vertebrae | |
| Date Received: 08/26/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 91 | 50-150 |
| d-MeFOSA | | 72 | 50-150 |
| d3-MeFOSAA | | 102 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-009
Description: MW-VRTB-3_08242022 | Matrix: Aqueous
Date Sampled: 08/24/2022 1940 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 09/30/2022 1620 | ALM | 09/14/2022 1016 | 54120 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 34 | U | 68 | 34 | 17 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 17 | U | 34 | 17 | 8.5 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.6 | J | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 5.0 | JM-03 | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 150 | S | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 18 | | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 9.4 | JM-03 | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 26 | SM-03 | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 6.8 | J | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 22 | SM-03 | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 22 | S | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 8.5 | U | 17 | 8.5 | 4.3 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 580 | SM-03 | 17 | 8.5 | 4.3 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 98 | 50-150 |
| 13C2_6:2FTS | | 103 | 50-150 |
| 13C2_8:2FTS | | 97 | 50-150 |
| 13C2_PFDoA | | 93 | 50-150 |
| 13C2_PFTeDA | | 88 | 50-150 |
| 13C3_PFBS | | 96 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 101 | 50-150 |
| 13C4_PFHpA | | 107 | 50-150 |
| 13C5_PFHxA | | 100 | 50-150 |
| 13C5_PFPeA | | 99 | 50-150 |
| 13C6_PFDA | M-03 | 82 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 102 | 50-150 |
| 13C8_PFOS | | 95 | 50-150 |
| 13C8_PFOSA | | 92 | 50-150 |
| 13C9_PFNA | | 100 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XH26042-009 |
| Description: MW-VRTB-3_08242022 | | | Matrix: Aqueous |
| Date Sampled: 08/24/2022 1940 | | Project Name: ESTCP Vertebrae | |
| Date Received: 08/26/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 92 | 50-150 |
| d-MeFOSA | | 103 | 50-150 |
| d3-MeFOSAA | | 93 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-012
Description: CMT-VRTB-01_4_08252022 | Matrix: Aqueous
Date Sampled: 08/25/2022 1035 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/29/2022 1409 | ALM | 09/15/2022 1102 | 54228 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 09/30/2022 1942 | ALM | 09/15/2022 1102 | 54228 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 220 | | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 1100 | | 36 | 18 | 8.9 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.9 | JM-03 | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.6 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 23 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 9.5 | M-03 | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | UM-03 | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 19 | M-03 | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 520 | | 18 | 9.0 | 4.4 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 250 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 8.3 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 260 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 660 | | 18 | 9.0 | 4.4 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 25 | M-03 | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 170 | M-03 | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 1000 | | 18 | 9.0 | 4.4 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 620 | M-03 | 18 | 9.0 | 4.4 | ng/L | 2 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 108 | 50-150 | | 99 | 50-150 |
| 13C2_6:2FTS | | 121 | 50-150 | | 99 | 50-150 |
| 13C2_8:2FTS | | 92 | 50-150 | M-03 | 86 | 50-150 |
| 13C2_PFDoA | | 65 | 50-150 | | 73 | 50-150 |
| 13C2_PFTeDA | | 64 | 50-150 | | 62 | 50-150 |
| 13C3_PFBS | | 89 | 50-150 | | 95 | 50-150 |
| 13C3_PFHxS | | 81 | 50-150 | | 87 | 50-150 |
| 13C4_PFBA | | 64 | 50-150 | | 84 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 | | 85 | 50-150 |
| 13C5_PFHxA | | 82 | 50-150 | | 93 | 50-150 |
| 13C5_PFPeA | | 75 | 50-150 | | 97 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 | | 77 | 50-150 |
| 13C7_PFUdA | | 81 | 50-150 | | 86 | 50-150 |
| 13C8_PFOA | | 85 | 50-150 | | 96 | 50-150 |
| 13C8_PFOS | | 85 | 50-150 | | 91 | 50-150 |
| 13C8_PFOSA | | 87 | 50-150 | M-03 | 84 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH26042-012
Description: CMT-VRTB-01_4_08252022
Matrix: Aqueous
Date Sampled: 08/25/2022 1035
Project Name: ESTCP Vertebrae
Date Received: 08/26/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 89 | 50-150 | | 87 | 50-150 |
| d5-EtFOSAA | | 78 | 50-150 | | 79 | 50-150 |
| d-MeFOSA | | 62 | 50-150 | M-03 | 87 | 50-150 |
| d3-MeFOSAA | | 78 | 50-150 | | 82 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-013
Description: CMT-VRTB-01_5_08252022 | Matrix: Aqueous
Date Sampled: 08/25/2022 1110 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/29/2022 1420 | ALM | 09/15/2022 1102 | 54228 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.8 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.3 | JM-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 48 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 11 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 2.5 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 3.6 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.4 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 11 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 4.5 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 32 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 142 | 50-150 |
| 13C2_6:2FTS | N | 221 | 50-150 |
| 13C2_8:2FTS | | 103 | 50-150 |
| 13C2_PFDoA | | 78 | 50-150 |
| 13C2_PFTeDA | | 85 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 98 | 50-150 |
| 13C7_PFUdA | | 91 | 50-150 |
| 13C8_PFOA | | 96 | 50-150 |
| 13C8_PFOS | | 99 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 101 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XH26042-013 |
| Description: CMT-VRTB-01_5_08252022 | | | Matrix: Aqueous |
| Date Sampled: 08/25/2022 1110 | | Project Name: ESTCP Vertebrae | |
| Date Received: 08/26/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 89 | 50-150 |
| d-MeFOSA | | 77 | 50-150 |
| d3-MeFOSAA | | 90 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-014
Description: CMT-VRTB-01_6_08252022 | Matrix: Aqueous
Date Sampled: 08/25/2022 1140 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1712 | LAB | 09/15/2022 1253 | 54257 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.3 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 6.6 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 12 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 190 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 12 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 12 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 23 | M-03 | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 16 | M-03 | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 14 | M-03 | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 140 | | 3.5 | 1.8 | 0.88 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 93 | 50-150 |
| 13C2_6:2FTS | | 134 | 50-150 |
| 13C2_8:2FTS | | 94 | 50-150 |
| 13C2_PFDoA | | 86 | 50-150 |
| 13C2_PFTeDA | | 90 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 91 | 50-150 |
| 13C4_PFHpA | | 92 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 97 | 50-150 |
| 13C6_PFDA | | 79 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 |
| 13C8_PFOA | | 100 | 50-150 |
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 94 | 50-150 |
| 13C9_PFNA | | 97 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH26042-014
Description: CMT-VRTB-01_6_08252022
Matrix: Aqueous
Date Sampled: 08/25/2022 1140
Project Name: ESTCP Vertebrae
Date Received: 08/26/2022
Project Number: 30027244.00003

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 77 | 50-150 |
| d3-MeFOSAA | | 106 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH26042-015
Description: CMT-VRTB-01_7_08252022 | Matrix: Aqueous
Date Sampled: 08/25/2022 1210 | Project Name: ESTCP Vertebrae
Date Received: 08/26/2022 | Project Number: 30027244.00003

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1723 | LAB | 09/15/2022 1253 | 54257 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.1 | JM-03 | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 0.92 | J | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.8 | JM-03 | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 28 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 4.3 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 2.4 | JM-03 | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 1.7 | J | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 1.7 | JM-03 | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 16 | M-03 | 3.4 | 1.7 | 0.85 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 100 | 50-150 |
| 13C2_6:2FTS | N | 187 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 |
| 13C2_PFDoA | | 96 | 50-150 |
| 13C2_PFTeDA | | 89 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 102 | 50-150 |
| 13C5_PFHxA | | 102 | 50-150 |
| 13C5_PFPeA | | 95 | 50-150 |
| 13C6_PFDA | | 91 | 50-150 |
| 13C7_PFUdA | | 84 | 50-150 |
| 13C8_PFOA | | 102 | 50-150 |
| 13C8_PFOS | | 100 | 50-150 |
| 13C8_PFOSA | | 99 | 50-150 |
| 13C9_PFNA | | 103 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: XH26042-015 |
| Description: CMT-VRTB-01_7_08252022 | | | Matrix: Aqueous |
| Date Sampled: 08/25/2022 1210 | | Project Name: ESTCP Vertebrae | |
| Date Received: 08/26/2022 | | Project Number: 30027244.00003 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 87 | 50-150 |
| d-MeFOSA | | 72 | 50-150 |
| d3-MeFOSAA | | 93 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# Inorganic non-metals - MB

Sample ID: XQ53178-001
Batch: 53178
Analytical Method: SM 5310C-2014

Matrix: Aqueous

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| TOC | 1.5 | U | 1 | 2.0 | 1.5 | 0.60 | mg/L | 09/03/2022 1252 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# Inorganic non-metals - LCS

Sample ID: XQ53178-002
Batch: 53178
Analytical Method: SM 5310C-2014
Matrix: Aqueous

| Parameter | Spike Amount (mg/L) | Result (mg/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| TOC | 20 | 20 | | 1 | 101 | 90-110 | 09/03/2022 1303 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Sample ID: XH26042-001MS
Batch: 53178
Analytical Method: SM 5310C-2014
Matrix: Aqueous

| Parameter | Sample Amount (mg/L) | Spike Amount (mg/L) | Result (mg/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| TOC | 26 | 50 | 82 | | 1 | 113 | 70-130 | 09/03/2022 1350 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# Inorganic non-metals - MSD

Sample ID: XH26042-001MD
Batch: 53178
Analytical Method: SM 5310C-2014

Matrix: Aqueous

| Parameter | Sample Amount (mg/L) | Spike Amount (mg/L) | Result (mg/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| TOC | 26 | 50 | 79 | | 1 | 108 | 3.3 | 70-130 | 20 | 09/03/2022 1401 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ54120-001
Batch: 54120
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/14/2022 1016

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1954 |
| 6:2 FTS | 4.0 | UM-03 | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1954 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1954 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1954 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 09/28/2022 1954 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1954 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFOSA | 2.0 | UM-03 | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |
| PFOS | 2.0 | UM-03 | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1954 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 126 | 50-150 |
| 13C2_6:2FTS | | 120 | 50-150 |
| 13C2_8:2FTS | | 129 | 50-150 |
| 13C2_PFDoA | | 116 | 50-150 |
| 13C2_PFTeDA | | 102 | 50-150 |
| 13C3_PFBS | | 117 | 50-150 |
| 13C3_PFHxS | | 119 | 50-150 |
| 13C4_PFBA | | 130 | 50-150 |
| 13C4_PFHpA | | 127 | 50-150 |
| 13C5_PFHxA | | 127 | 50-150 |
| 13C5_PFPeA | | 121 | 50-150 |
| 13C6_PFDA | | 120 | 50-150 |
| 13C7_PFUdA | | 117 | 50-150 |
| 13C8_PFOA | | 121 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ54120-001
Batch: 54120
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/14/2022 1016

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 123 | 50-150 |
| 13C8_PFOSA | | 122 | 50-150 |
| 13C9_PFNA | | 126 | 50-150 |
| d5-EtFOSAA | | 117 | 50-150 |
| d-MeFOSA | | 84 | 50-150 |
| d3-MeFOSAA | | 128 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ54120-002
Batch: 54120
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/14/2022 1016

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 18 | | 1 | 114 | 67-138 | 09/28/2022 2007 |
| 6:2 FTS | 15 | 17 | | 1 | 111 | 64-140 | 09/28/2022 2007 |
| 4:2 FTS | 15 | 16 | | 1 | 105 | 63-143 | 09/28/2022 2007 |
| EtFOSAA | 16 | 17 | | 1 | 105 | 61-135 | 09/28/2022 2007 |
| MeFOSA | 16 | 20 | | 1 | 122 | 68-141 | 09/28/2022 2007 |
| MeFOSAA | 16 | 17 | M-03 | 1 | 103 | 65-136 | 09/28/2022 2007 |
| PFBS | 14 | 14 | | 1 | 99 | 72-130 | 09/28/2022 2007 |
| PFDS | 15 | 15 | | 1 | 96 | 53-142 | 09/28/2022 2007 |
| PFHpS | 15 | 15 | | 1 | 98 | 69-134 | 09/28/2022 2007 |
| PFNS | 15 | 15 | | 1 | 94 | 69-127 | 09/28/2022 2007 |
| PFOSA | 16 | 18 | | 1 | 111 | 67-137 | 09/28/2022 2007 |
| PFPeS | 15 | 16 | | 1 | 104 | 71-127 | 09/28/2022 2007 |
| PFHxS | 15 | 16 | M-03 | 1 | 108 | 68-131 | 09/28/2022 2007 |
| PFBA | 16 | 16 | | 1 | 99 | 73-129 | 09/28/2022 2007 |
| PFDA | 16 | 16 | | 1 | 101 | 71-129 | 09/28/2022 2007 |
| PFDoA | 16 | 15 | | 1 | 95 | 72-134 | 09/28/2022 2007 |
| PFHpA | 16 | 16 | | 1 | 101 | 72-130 | 09/28/2022 2007 |
| PFHxA | 16 | 16 | | 1 | 103 | 72-129 | 09/28/2022 2007 |
| PFNA | 16 | 16 | | 1 | 98 | 69-130 | 09/28/2022 2007 |
| PFOA | 16 | 17 | | 1 | 103 | 71-133 | 09/28/2022 2007 |
| PFPeA | 16 | 16 | | 1 | 101 | 72-129 | 09/28/2022 2007 |
| PFTeDA | 16 | 15 | | 1 | 96 | 71-132 | 09/28/2022 2007 |
| PFTrDA | 16 | 16 | | 1 | 99 | 65-144 | 09/28/2022 2007 |
| PFUdA | 16 | 15 | | 1 | 96 | 69-133 | 09/28/2022 2007 |
| PFOS | 15 | 14 | | 1 | 96 | 65-140 | 09/28/2022 2007 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 122 | 50-150 |
| 13C2_6:2FTS | | 120 | 50-150 |
| 13C2_8:2FTS | | 125 | 50-150 |
| 13C2_PFDoA | | 108 | 50-150 |
| 13C2_PFTeDA | | 94 | 50-150 |
| 13C3_PFBS | | 116 | 50-150 |
| 13C3_PFHxS | | 119 | 50-150 |
| 13C4_PFBA | | 127 | 50-150 |
| 13C4_PFHpA | | 122 | 50-150 |
| 13C5_PFHxA | | 122 | 50-150 |
| 13C5_PFPeA | | 117 | 50-150 |
| 13C6_PFDA | | 117 | 50-150 |
| 13C7_PFUdA | | 114 | 50-150 |
| 13C8_PFOA | | 118 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ54120-002
Batch: 54120
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/14/2022 1016

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 122 | 50-150 |
| 13C8_PFOSA | | 119 | 50-150 |
| 13C9_PFNA | | 124 | 50-150 |
| d5-EtFOSAA | | 111 | 50-150 |
| d-MeFOSA | | 94 | 50-150 |
| d3-MeFOSAA | | 121 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XH26042-009MS
Batch: 54120
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/14/2022 1016

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | 15 | 11 | | 5 | 69 | 67-138 | 09/30/2022 1631 |
| 6:2 FTS | ND | 15 | 14 | | 5 | 95 | 64-140 | 09/30/2022 1631 |
| 4:2 FTS | ND | 15 | 11 | | 5 | 77 | 63-143 | 09/30/2022 1631 |
| EtFOSAA | ND | 16 | 15 | M-03 | 5 | 96 | 61-135 | 09/30/2022 1631 |
| MeFOSA | ND | 16 | 12 | M-03 | 5 | 72 | 68-141 | 09/30/2022 1631 |
| MeFOSAA | ND | 16 | 12 | M-03 | 5 | 76 | 65-136 | 09/30/2022 1631 |
| PFBS | ND | 14 | 17 | | 5 | 121 | 72-130 | 09/30/2022 1631 |
| PFDS | ND | 15 | 11 | | 5 | 70 | 53-142 | 09/30/2022 1631 |
| PFHpS | 7.6 | 15 | 19 | | 5 | 77 | 69-134 | 09/30/2022 1631 |
| PFNS | ND | 15 | 12 | | 5 | 78 | 69-127 | 09/30/2022 1631 |
| PFOSA | ND | 16 | 16 | | 5 | 99 | 67-137 | 09/30/2022 1631 |
| PFPeS | 5.0 | 15 | 18 | M-03 | 5 | 84 | 71-127 | 09/30/2022 1631 |
| PFHxS | 150 | 15 | 150 | N | 5 | 42 | 68-131 | 09/30/2022 1631 |
| PFBA | 18 | 16 | 33 | | 5 | 91 | 73-129 | 09/30/2022 1631 |
| PFDA | ND | 16 | 15 | | 5 | 92 | 71-129 | 09/30/2022 1631 |
| PFDoA | ND | 16 | 13 | | 5 | 79 | 72-134 | 09/30/2022 1631 |
| PFHpA | 9.4 | 16 | 25 | | 5 | 96 | 72-130 | 09/30/2022 1631 |
| PFHxA | 26 | 16 | 45 | M-03 | 5 | 118 | 72-129 | 09/30/2022 1631 |
| PFNA | 6.8 | 16 | 21 | | 5 | 87 | 69-130 | 09/30/2022 1631 |
| PFOA | 22 | 16 | 32 | NM-03 | 5 | 61 | 71-133 | 09/30/2022 1631 |
| PFPeA | 22 | 16 | 31 | N | 5 | 58 | 72-129 | 09/30/2022 1631 |
| PFTeDA | ND | 16 | 13 | | 5 | 84 | 71-132 | 09/30/2022 1631 |
| PFTrDA | ND | 16 | 14 | | 5 | 87 | 65-144 | 09/30/2022 1631 |
| PFUdA | ND | 16 | 14 | | 5 | 86 | 69-133 | 09/30/2022 1631 |
| PFOS | 580 | 15 | 570 | NM-03 | 5 | -14 | 65-140 | 09/30/2022 1631 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 104 | 50-150 |
| 13C2_6:2FTS | | 111 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 |
| 13C2_PFDoA | | 83 | 50-150 |
| 13C2_PFTeDA | | 84 | 50-150 |
| 13C3_PFBS | | 89 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 |
| 13C4_PFHpA | | 87 | 50-150 |
| 13C5_PFHxA | | 86 | 50-150 |
| 13C5_PFPeA | | 103 | 50-150 |
| 13C6_PFDA | | 77 | 50-150 |
| 13C7_PFUdA | | 88 | 50-150 |
| 13C8_PFOA | | 97 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: XH26042-009MS
Batch: 54120
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/14/2022 1016

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 89 | 50-150 |
| 13C8_PFOSA | | 93 | 50-150 |
| 13C9_PFNA | | 94 | 50-150 |
| d5-EtFOSAA | | 82 | 50-150 |
| d-MeFOSA | | 95 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Sample ID: XH26042-009MD
Batch: 54120
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/14/2022 1016

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | ND | 15 | 14 | | 5 | 91 | 28 | 67-138 | 30 | 09/30/2022 1641 |
| 6:2 FTS | ND | 15 | 13 | | 5 | 86 | 11 | 64-140 | 30 | 09/30/2022 1641 |
| 4:2 FTS | ND | 15 | 17 | M-03,+ | 5 | 114 | 40 | 63-143 | 30 | 09/30/2022 1641 |
| EtFOSAA | ND | 16 | 14 | M-03 | 5 | 90 | 6.4 | 61-135 | 30 | 09/30/2022 1641 |
| MeFOSA | ND | 16 | 18 | + | 5 | 115 | 46 | 68-141 | 30 | 09/30/2022 1641 |
| MeFOSAA | ND | 16 | 15 | M-03 | 5 | 93 | 20 | 65-136 | 30 | 09/30/2022 1641 |
| PFBS | ND | 14 | 15 | | 5 | 108 | 12 | 72-130 | 30 | 09/30/2022 1641 |
| PFDS | ND | 15 | 11 | | 5 | 72 | 1.8 | 53-142 | 30 | 09/30/2022 1641 |
| PFHpS | 7.6 | 15 | 19 | | 5 | 77 | 0.036 | 69-134 | 30 | 09/30/2022 1641 |
| PFNS | ND | 15 | 11 | | 5 | 73 | 6.1 | 69-127 | 30 | 09/30/2022 1641 |
| PFOSA | ND | 16 | 16 | M-03 | 5 | 102 | 2.4 | 67-137 | 30 | 09/30/2022 1641 |
| PFPeS | 5.0 | 15 | 17 | M-03 | 5 | 81 | 2.6 | 71-127 | 30 | 09/30/2022 1641 |
| PFHxS | 150 | 15 | 160 | | 5 | 84 | 4.0 | 68-131 | 30 | 09/30/2022 1641 |
| PFBA | 18 | 16 | 32 | | 5 | 82 | 4.6 | 73-129 | 30 | 09/30/2022 1641 |
| PFDA | ND | 16 | 15 | | 5 | 91 | 0.64 | 71-129 | 30 | 09/30/2022 1641 |
| PFDoA | ND | 16 | 13 | | 5 | 79 | 0.35 | 72-134 | 30 | 09/30/2022 1641 |
| PFHpA | 9.4 | 16 | 21 | | 5 | 74 | 15 | 72-130 | 30 | 09/30/2022 1641 |
| PFHxA | 26 | 16 | 37 | NM-03 | 5 | 67 | 20 | 72-129 | 30 | 09/30/2022 1641 |
| PFNA | 6.8 | 16 | 21 | | 5 | 88 | 1.1 | 69-130 | 30 | 09/30/2022 1641 |
| PFOA | 22 | 16 | 30 | N | 5 | 49 | 6.3 | 71-133 | 30 | 09/30/2022 1641 |
| PFPeA | 22 | 16 | 32 | N | 5 | 64 | 3.2 | 72-129 | 30 | 09/30/2022 1641 |
| PFTeDA | ND | 16 | 12 | | 5 | 77 | 9.3 | 71-132 | 30 | 09/30/2022 1641 |
| PFTrDA | ND | 16 | 13 | | 5 | 83 | 4.9 | 65-144 | 30 | 09/30/2022 1641 |
| PFUdA | ND | 16 | 12 | | 5 | 78 | 9.8 | 69-133 | 30 | 09/30/2022 1641 |
| PFOS | 580 | 15 | 550 | NM-03 | 5 | -164 | 4.0 | 65-140 | 30 | 09/30/2022 1641 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 105 | 50-150 |
| 13C2_6:2FTS | | 122 | 50-150 |
| 13C2_8:2FTS | | 104 | 50-150 |
| 13C2_PFDoA | | 86 | 50-150 |
| 13C2_PFTeDA | | 90 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 |
| 13C3_PFHxS | | 103 | 50-150 |
| 13C4_PFBA | | 101 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 |
| 13C5_PFHxA | | 102 | 50-150 |
| 13C5_PFPeA | | 105 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 99 | 50-150 |
| 13C8_PFOA | | 100 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Sample ID: XH26042-009MD
Batch: 54120
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/14/2022 1016

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 105 | 50-150 |
| 13C8_PFOSA | | 85 | 50-150 |
| 13C9_PFNA | | 96 | 50-150 |
| d5-EtFOSAA | | 90 | 50-150 |
| d-MeFOSA | | 81 | 50-150 |
| d3-MeFOSAA | | 89 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ54228-001
Batch: 54228
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1102

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1733 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1733 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1733 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1733 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 09/28/2022 1733 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1733 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 92 | 50-150 |
| 13C2_6:2FTS | | 106 | 50-150 |
| 13C2_8:2FTS | | 83 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 72 | 50-150 |
| 13C3_PFBS | | 82 | 50-150 |
| 13C3_PFHxS | | 84 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 83 | 50-150 |
| 13C5_PFHxA | | 88 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 |
| 13C6_PFDA | | 84 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 84 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ54228-001
Batch: 54228
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1102

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 81 | 50-150 |
| 13C8_PFOSA | | 84 | 50-150 |
| 13C9_PFNA | | 85 | 50-150 |
| d5-EtFOSAA | | 86 | 50-150 |
| d-MeFOSA | | 68 | 50-150 |
| d3-MeFOSAA | | 83 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - LCS

Sample ID: XQ54228-002
Batch: 54228
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1102

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 17 | | 1 | 113 | 67-138 | 09/28/2022 1722 |
| 6:2 FTS | 15 | 20 | | 1 | 133 | 64-140 | 09/28/2022 1722 |
| 4:2 FTS | 15 | 15 | | 1 | 103 | 63-143 | 09/28/2022 1722 |
| EtFOSAA | 16 | 18 | M-03 | 1 | 111 | 61-135 | 09/28/2022 1722 |
| MeFOSA | 16 | 19 | M-03 | 1 | 116 | 68-141 | 09/28/2022 1722 |
| MeFOSAA | 16 | 16 | M-03 | 1 | 99 | 65-136 | 09/28/2022 1722 |
| PFBS | 14 | 14 | | 1 | 98 | 72-130 | 09/28/2022 1722 |
| PFDS | 15 | 14 | | 1 | 90 | 53-142 | 09/28/2022 1722 |
| PFHpS | 15 | 15 | M-03 | 1 | 99 | 69-134 | 09/28/2022 1722 |
| PFNS | 15 | 16 | | 1 | 101 | 69-127 | 09/28/2022 1722 |
| PFOSA | 16 | 17 | M-03 | 1 | 109 | 67-137 | 09/28/2022 1722 |
| PFPeS | 15 | 15 | | 1 | 102 | 71-127 | 09/28/2022 1722 |
| PFHxS | 15 | 14 | M-03 | 1 | 99 | 68-131 | 09/28/2022 1722 |
| PFBA | 16 | 16 | | 1 | 103 | 73-129 | 09/28/2022 1722 |
| PFDA | 16 | 17 | | 1 | 104 | 71-129 | 09/28/2022 1722 |
| PFDoA | 16 | 16 | | 1 | 99 | 72-134 | 09/28/2022 1722 |
| PFHpA | 16 | 16 | | 1 | 102 | 72-130 | 09/28/2022 1722 |
| PFHxA | 16 | 16 | | 1 | 99 | 72-129 | 09/28/2022 1722 |
| PFNA | 16 | 16 | | 1 | 98 | 69-130 | 09/28/2022 1722 |
| PFOA | 16 | 16 | | 1 | 102 | 71-133 | 09/28/2022 1722 |
| PFPeA | 16 | 17 | | 1 | 103 | 72-129 | 09/28/2022 1722 |
| PFTeDA | 16 | 16 | | 1 | 101 | 71-132 | 09/28/2022 1722 |
| PFTrDA | 16 | 15 | | 1 | 91 | 65-144 | 09/28/2022 1722 |
| PFUdA | 16 | 16 | M-03 | 1 | 101 | 69-133 | 09/28/2022 1722 |
| PFOS | 15 | 15 | M-03 | 1 | 100 | 65-140 | 09/28/2022 1722 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 124 | 50-150 |
| 13C2_8:2FTS | | 81 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 |
| 13C2_PFTeDA | | 71 | 50-150 |
| 13C3_PFBS | | 90 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 84 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ54228-002
Batch: 54228
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1102

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 89 | 50-150 |
| 13C8_PFOSA | | 88 | 50-150 |
| 13C9_PFNA | | 89 | 50-150 |
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 74 | 50-150 |
| d3-MeFOSAA | | 85 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ54257-001
Batch: 54257
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1253

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1516 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1516 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1516 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1516 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 09/28/2022 1516 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1516 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFOS | 2.0 | UM-03 | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 109 | 50-150 |
| 13C2_8:2FTS | | 132 | 50-150 |
| 13C2_PFDoA | | 107 | 50-150 |
| 13C2_PFTeDA | | 94 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 108 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 |
| 13C5_PFPeA | | 103 | 50-150 |
| 13C6_PFDA | | 88 | 50-150 |
| 13C7_PFUdA | | 102 | 50-150 |
| 13C8_PFOA | | 104 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ54257-001
Batch: 54257
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1253

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 100 | 50-150 |
| d5-EtFOSAA | | 108 | 50-150 |
| d-MeFOSA | | 66 | 50-150 |
| d3-MeFOSAA | | 106 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ54257-002
Batch: 54257
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1253

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 17 | | 1 | 112 | 67-138 | 09/28/2022 1526 |
| 6:2 FTS | 15 | 16 | | 1 | 105 | 64-140 | 09/28/2022 1526 |
| 4:2 FTS | 15 | 17 | | 1 | 114 | 63-143 | 09/28/2022 1526 |
| EtFOSAA | 16 | 15 | | 1 | 96 | 61-135 | 09/28/2022 1526 |
| MeFOSA | 16 | 21 | | 1 | 130 | 68-141 | 09/28/2022 1526 |
| MeFOSAA | 16 | 18 | M-03 | 1 | 110 | 65-136 | 09/28/2022 1526 |
| PFBS | 14 | 14 | | 1 | 96 | 72-130 | 09/28/2022 1526 |
| PFDS | 15 | 14 | | 1 | 93 | 53-142 | 09/28/2022 1526 |
| PFHpS | 15 | 15 | | 1 | 100 | 69-134 | 09/28/2022 1526 |
| PFNS | 15 | 15 | | 1 | 98 | 69-127 | 09/28/2022 1526 |
| PFOSA | 16 | 16 | | 1 | 102 | 67-137 | 09/28/2022 1526 |
| PFPeS | 15 | 14 | | 1 | 95 | 71-127 | 09/28/2022 1526 |
| PFHxS | 15 | 14 | | 1 | 95 | 68-131 | 09/28/2022 1526 |
| PFBA | 16 | 16 | | 1 | 100 | 73-129 | 09/28/2022 1526 |
| PFDA | 16 | 16 | | 1 | 98 | 71-129 | 09/28/2022 1526 |
| PFDoA | 16 | 16 | | 1 | 101 | 72-134 | 09/28/2022 1526 |
| PFHpA | 16 | 16 | | 1 | 102 | 72-130 | 09/28/2022 1526 |
| PFHxA | 16 | 19 | | 1 | 119 | 72-129 | 09/28/2022 1526 |
| PFNA | 16 | 16 | | 1 | 102 | 69-130 | 09/28/2022 1526 |
| PFOA | 16 | 16 | | 1 | 99 | 71-133 | 09/28/2022 1526 |
| PFPeA | 16 | 16 | | 1 | 102 | 72-129 | 09/28/2022 1526 |
| PFTeDA | 16 | 17 | | 1 | 103 | 71-132 | 09/28/2022 1526 |
| PFTrDA | 16 | 14 | | 1 | 87 | 65-144 | 09/28/2022 1526 |
| PFUdA | 16 | 15 | | 1 | 95 | 69-133 | 09/28/2022 1526 |
| PFOS | 15 | 16 | | 1 | 106 | 65-140 | 09/28/2022 1526 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 104 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 |
| 13C2_PFDoA | | 101 | 50-150 |
| 13C2_PFTeDA | | 85 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 |
| 13C3_PFHxS | | 98 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 90 | 50-150 |
| 13C6_PFDA | | 81 | 50-150 |
| 13C7_PFUdA | | 94 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ54257-002
Batch: 54257
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1253

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 90 | 50-150 |
| 13C8_PFOSA | | 96 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 60 | 50-150 |
| d3-MeFOSAA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ56292-001
Batch: 56292
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 10/06/2022 1957

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2022 1810 |
| 6:2 FTS | 4.0 | UM-03 | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2022 1810 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2022 1810 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2022 1810 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/11/2022 1810 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2022 1810 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 107 | 50-150 |
| 13C2_6:2FTS | N | 333 | 50-150 |
| 13C2_8:2FTS | | 106 | 50-150 |
| 13C2_PFDoA | | 95 | 50-150 |
| 13C2_PFTeDA | | 82 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 |
| 13C5_PFHxA | | 97 | 50-150 |
| 13C5_PFPeA | | 98 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 |
| 13C7_PFUdA | | 94 | 50-150 |
| 13C8_PFOA | | 95 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ56292-001
Batch: 56292
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 10/06/2022 1957

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 99 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d5-EtFOSAA | | 101 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 101 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ56292-002
Batch: 56292
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 10/06/2022 1957

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 16 | M-03 | 1 | 105 | 67-138 | 10/11/2022 1821 |
| 6:2 FTS | 15 | 15 | | 1 | 101 | 64-140 | 10/11/2022 1821 |
| 4:2 FTS | 15 | 16 | | 1 | 109 | 63-143 | 10/11/2022 1821 |
| EtFOSAA | 16 | 16 | M-03 | 1 | 99 | 61-135 | 10/11/2022 1821 |
| MeFOSA | 16 | 16 | | 1 | 103 | 68-141 | 10/11/2022 1821 |
| MeFOSAA | 16 | 14 | M-03 | 1 | 90 | 65-136 | 10/11/2022 1821 |
| PFBS | 14 | 14 | | 1 | 102 | 72-130 | 10/11/2022 1821 |
| PFDS | 15 | 14 | | 1 | 89 | 53-142 | 10/11/2022 1821 |
| PFHpS | 15 | 16 | | 1 | 103 | 69-134 | 10/11/2022 1821 |
| PFNS | 15 | 14 | | 1 | 89 | 69-127 | 10/11/2022 1821 |
| PFOSA | 16 | 15 | | 1 | 91 | 67-137 | 10/11/2022 1821 |
| PFPeS | 15 | 14 | | 1 | 96 | 71-127 | 10/11/2022 1821 |
| PFHxS | 15 | 15 | | 1 | 103 | 68-131 | 10/11/2022 1821 |
| PFBA | 16 | 16 | | 1 | 100 | 73-129 | 10/11/2022 1821 |
| PFDA | 16 | 17 | | 1 | 104 | 71-129 | 10/11/2022 1821 |
| PFDoA | 16 | 16 | | 1 | 101 | 72-134 | 10/11/2022 1821 |
| PFHpA | 16 | 16 | | 1 | 100 | 72-130 | 10/11/2022 1821 |
| PFHxA | 16 | 17 | | 1 | 103 | 72-129 | 10/11/2022 1821 |
| PFNA | 16 | 16 | | 1 | 97 | 69-130 | 10/11/2022 1821 |
| PFOA | 16 | 15 | | 1 | 95 | 71-133 | 10/11/2022 1821 |
| PFPeA | 16 | 16 | | 1 | 100 | 72-129 | 10/11/2022 1821 |
| PFTeDA | 16 | 17 | | 1 | 103 | 71-132 | 10/11/2022 1821 |
| PFTrDA | 16 | 16 | | 1 | 97 | 65-144 | 10/11/2022 1821 |
| PFUdA | 16 | 17 | | 1 | 108 | 69-133 | 10/11/2022 1821 |
| PFOS | 15 | 15 | M-03 | 1 | 100 | 65-140 | 10/11/2022 1821 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 106 | 50-150 |
| 13C2_6:2FTS | N | 354 | 50-150 |
| 13C2_8:2FTS | | 108 | 50-150 |
| 13C2_PFDoA | | 96 | 50-150 |
| 13C2_PFTeDA | | 89 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 99 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 |
| 13C8_PFOA | | 96 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ56292-002
Batch: 56292
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 10/06/2022 1957

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 97 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d5-EtFOSAA | | 104 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 101 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 111030

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: 231-534-5092 / khasbrouck@tetratech.com, 734-385-5347 / Craig.Divine@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x [signature] | Analysis (Attach list if more space is needed) | Page 1 of 2 |
| City: Novi / State: MI / Zip Code: 48377 | Printed Name: Austin Westhuis | | |
| Project Name: ESTCP Vertebrae - Grayling, MI | | | XH26042 |
| Project No.: 30017244.00003 | P.O. No. | | KES2 |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab/Composite | Matrix: Aqueous | Soil | Tissue/Other | No of Containers by Preservative Type: Unpres. | H2SO4 | HNO3 | HCl | NaOH | 5035 kit | Field Filtered | PFAS 533 w/ isotope dilution Arcadis QSM 5.3 | TOC | Top Assay | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-S-M5_08242022 | 8/24/22 | 1235 | G | X | | | 2 | 1 | | | | | | X | X | | |
| VRTB-S-06_08242022 | 8/24/22 | 1355 | G | X | | | 2 | | | | | | | X | | | |
| VRTB-S-R7_08242022 | 8/24/22 | 1450 | G | X | | | 2 | 1 | | | | | | X | X | | |
| VRTB-S-P8_08242022 | 8/24/22 | 1600 | G | X | | | 2 | | | | | | | X | | | |
| MW-VRTB-1S_08242022 | 8/24/22 | 1655 | G | X | | | 2 | | | | | | | X | | | |
| MW-VRTB-1D_08242022 | 8/24/22 | 1730 | G | X | | | 2 | | | | | | | X | | | |
| MW-VRTB-2S_08242022 | 8/24/22 | 1815 | G | X | | | 2 | | | | | | | X | | | |
| MW-VRTB-2D_08242022 | 8/24/22 | 1850 | G | X | | | 2 | | | | | | | X | | | |
| MW-VRTB-3_08242022 | 8/24/22 | 1940 | G | X | | | 6 | | | | | | | X | | | |
| CMT-VRTB-01_2_08252022 | 8/25/22 | 0905 | G | X | | | 2 | | | | | | | | | X | MS/MSD |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify)

**Sample Disposal**: ☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification**: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by: [signature] / Austin Westhuis / Arcadis | 8/25/22 | 1700 | 1. Received by: FedEx | 8/25/22 | 1700 |
| 2. Relinquished by | Date | Time | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: FedEx | 8-26-22 | 940 | 4. Laboratory received by: [signature] | 8.26.22 | 940 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

**LAB USE ONLY**
Received on ice (Circle): (Yes) No — Ice Pack — Receipt Temp. 3.0 °C — Temp Blank ☐ Y ☒ N

**DISTRIBUTION:** WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

* Level II Package Required

Document Number: ME005N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 111031

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: 231-534-5012/khasbrouck@arcadis.com, 616-508-5367/Craig.Divine@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: X [signature] | Analysis (Attach list if more space is needed) | Page 2 of 2 |
| City: Novi / State: MI / Zip Code: 48377 | Printed Name: Austin Westhuis | | |
| Project Name: ESTCP Vertebrae - Grayling, MI | | | XH26042 |
| Project No.: 30027244.00003 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab / Composite | Matrix: Aqueous | Matrix: Solid | Matrix: Wipe / Air / Other | No. of Containers by Preservative Type: Unpres | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | NH4Cl | PFAS 48 USEPA Method 537 w/ isotope dilution and DoD 5.3 | Top Assay | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMT-VRTB-01_3_08252022 | 8/25/22 | 0955 | G | X | | | 2 | | | | | | | | X | |
| CMT-VRTB-01_4_08252022 | 8/25/22 | 1035 | G | X | | | 2 | | | | | | | X | | |
| CMT-VRTB-01_5_08252022 | 8/25/22 | 1110 | G | X | | | 2 | | | | | | | X | | |
| CMT-VRTB-01_6_08252022 | 8/25/22 | 1140 | G | X | | | 2 | | | | | | | X | | |
| CMT-VRTB-01_7_08252022 | 8/25/22 | 1210 | G | X | | | 2 | | | | | | | X | | |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.) ☒ Standard ☐ Rush (Specify)

**Sample Disposal** ☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification** ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | Date: 8/25/22 | Time: 1700 | 1. Received by: FedEx | Date: 8/25/22 | Time: 1700 |
| 2. Relinquished by | Date | Time | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: FedEx | Date: 8.26.22 | Time: 940 | 4. Laboratory received by: [signature] | Date: 8.26.22 | Time: 940 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle): Yes No Ice Pack — Receipt Temp: 3.0 °C — Temp Blank: ☐ Y ☐ N

**DISTRIBUTION:** WHITE & YELLOW-Return to laboratory with Sample(s), PINK-Field/Client Copy

* Level II Package Required

Document Number: ME003N2-01

DC#_Title: ENV-FRM-WCOL-0286 v02_Samples Receipt Checklist (SRC)
Effective Date: 8/2/2022

# Sample Receipt Checklist (SRC)

Client: Arcadis

Cooler Inspected by/date: KDRW / 08/26/2022 Lot #: XH26042

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No | ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: 22-1645 Chlorine Strip ID: NA Tested by: KDRW

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: NA

3.0 /3.0 °C NA /NA °C NA /NA °C NA /NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 8 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | ☐ NA | 3. Were all coolers received at or below 6.0°C? If no, was Project Manager notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 7. Was collection date & time listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 8. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 9. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 10. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 11. Was adequate sample volume available? |
| ☑ Yes | ☐ No | | 12. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☑ Yes | ☐ No | | 13. Were all samples containers accounted for? (No missing/excess) |
| ☐ Yes | ☐ No | ☑ NA | 14. Were VOA, 8015C and RSK-175 samples free of bubbles >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☑ Yes | ☐ No | ☐ NA | 15. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 16. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☑ Yes | ☐ No | ☐ NA | 18. Was the quote number listed on the container label? If yes, Quote # 25221 |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA. ☐
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Unique ID: NA.

Comments:

Qualtrax ID: 56360

Pace® Analytical Services, LLC

Page 1 of 1

# Report of Analysis

**Arcadis U.S., Inc.**
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Kristen Hasbrouck

Project Name: ESTCP Vertebrae

Project Number: 30027244.00003

Lot Number:**XH29054**

Date Completed:10/26/2022

10/27/2022 2:30 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: XH29054

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples were compliant with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a DoD/DOE accredited laboratory; however, the following analyses are currently not listed on our DoD/DOE scope of accreditation: Drinking Water: pH EPA 150.1, Turbidity EPA 18.01, Metals EPA 200.7

& 200.8, Mercury EPA 245.1, Anions EPA 300.0, Cyanide EPA 335.4, Nitrates EPA 353.2, Orthophosphate & Phosphorus EPA 365.1, EDB/DBCP EPA 504.1, HPC SIMPLATE, Color SM 2120 B-2011, Alkalinity SM 2320 B-2011, Specific Conductance SM 2510 B-2011, Residue-filterable (TDS) SM 2540 C, Calcium Hardness (CaCO2) SM 3500-Ca B-2011, TRC SM 4500 Cl G-2011, pH SM 4500 H=B-2011, E.Coli, Total Coliform; Non-Potable Water: Metals EPA 200.7, Strontium EPA 200.8, Chlorate EPA 300.0, Cyanide EPA 335.4, Phenolics EPA 420.4, 2-Methyl-4,6-Dinitrophenol EPA 625.1, Propane RSK-175, Specific Conductance SM 2510 B-2011, Salinity SM250 B, Residue- total SM 2540 B, Sulfite SM 4500 SO32- B-2011, Amenable Cyanide SM 4500-CN- G-2011, BOD & CBOD SM 5210 B, MBAS SM 5540 C-2011; Solid and Chemical Materials: Boron & Titanium SW-846 6010D, Boron, Molybdenum, & Titanium SW-846 6020B, Alcohols & Glycols SW-846 8015C, Pentachlorophenol SW-846 8151A, Ethyl Acetate, Hexane, & n-Hexane SW-846 8260D, SVOC 1,4-Dioxane, 3&4-Methylphenols, 4-Dimethyl aminoazobenzene, 1,4-Naphthoquinone, 3,5-Dinitroaniline, PETN SW-846 8270E, Amenable Cyanide SW-846 9012B; Boron & Titanium SW-846 6010D, Molybdenum SW-846 6020B, Ethylene Glycol SW-846 8015B, Pentachlorophenol SW-846 8151A, Chloroprene SW-846 8260B, SVOC 1,3,5-Trinitrobenzene, 1,4-Dioxane, 1,4-Naphthoquinone, 1,4-Phenylenediamine, 2,5-Dinitrotoluene, 2,6-Dinitrotoluene, 3-Methylcholanthrene, 4- Aminobiphenyl, 4-Dimethyl aminoazobenzene, 4-Nitroquinoline-1-oxide, 7,12- Dimethylbenzo(a)anthracene, Chlorobenzilate, Diallate, Ethyl methanesulfonate, Isodrin, Isosafrole, Methyl methanesulfonate, n-Nitrosomethylethylamine, n-Nitrosomorpholine, n-Nitrosopiperidine, Piperonyl butoxide, Pronamide, Safrole, 3,5-Dinitroaniline, PETN SW-846 8270E, Oil & Grease SW-846 9071B.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

For samples XH29054-004, XH29054-005, XH29054-006, and XH29054-008 sample matrix prevented full volume from being extracted, precluding method mandated bottle rinse. Elution solvent was aliquoted directly into the reservoir, rinsing the inside. Surrogate recovery may be adversely affected.

The method blank, laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for prep batches 53996, 56292 exceeded acceptance criteria for the following analytes: 6:2 FTS. The data has been reported.

Surrogate recovery for the following samples was outside the upper control limit: XH29054-001, XH29054-002, XH29054-003, XH29054-004, XH29054-009. This sample did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

Surrogate recovery for the following samples was outside control limits: XH29054-005, XH29054-006, XH29054-007, XH29054-008, XH29054-020, XH29054-021. Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Surrogate recovery for the following sample was outside control limits: XH29054-018, XH29054-019. Re-extraction and/or re-analysis was performed outside of holding time. Both sets of data have been reported.

The following samples required a dilution which was performed outside of the analytical holding time: XH29054-009, XH29054-018, XH29054-019, XH29054-020, XH29054-021. All data has been reported.

# Manual Integration Summary

## Arcadis U.S., Inc.

### Lot Number: XH29054

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| PFAS by ID SOP | XH29054-001 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-001 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-001 | 1 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH29054-002 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-002 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-002 | 1 | Perfluoro-n-nonanoic acid (PFNA) | M-03 |
| PFAS by ID SOP | XH29054-002 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-002 | 1 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH29054-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH29054-003 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-003 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-004 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-004 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| PFAS by ID SOP | XH29054-004 | 1 | Perfluoro-n-butanoic acid (PFBA) | M-03 |
| PFAS by ID SOP | XH29054-004 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-004 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH29054-005 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-005 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| PFAS by ID SOP | XH29054-005 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-005 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-005 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH29054-006 | 1 | 1H, 1H, 2H, 2H-perfluorooctane sulfonic | M-03 |
| PFAS by ID SOP | XH29054-006 | 1 | Perfluoro-1-butanesulfonic acid (PFBS) | M-03 |
| PFAS by ID SOP | XH29054-006 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-006 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-006 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| PFAS by ID SOP | XH29054-006 | 1 | Perfluoro-n-heptanoic acid (PFHpA) | M-03 |
| PFAS by ID SOP | XH29054-006 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-006 | 1 | Perfluoro-n-nonanoic acid (PFNA) | M-03 |
| PFAS by ID SOP | XH29054-006 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-006 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH29054-007 | 1 | 1H, 1H, 2H, 2H-perfluorooctane sulfonic | M-03 |
| PFAS by ID SOP | XH29054-007 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-007 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-007 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| PFAS by ID SOP | XH29054-007 | 1 | Perfluoro-n-butanoic acid (PFBA) | M-03 |
| PFAS by ID SOP | XH29054-007 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-007 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-007 | 2 | 13C2_6:2FTS | M-03 |
| PFAS by ID SOP | XH29054-007 | 1 | 13C2_PFDoA | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

### Lot Number: XH29054

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| PFAS by ID SOP | XH29054-008 | 1 | 1H, 1H, 2H, 2H-perfluorodecane | M-03 |
| PFAS by ID SOP | XH29054-008 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-008 | 1 | Perfluoro-n-heptanoic acid (PFHpA) | M-03 |
| PFAS by ID SOP | XH29054-008 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-008 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-008 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH29054-008 | 2 | 13C2_PFDoA | M-03 |
| PFAS by ID SOP | XH29054-008 | 2 | 13C7_PFUdA | M-03 |
| PFAS by ID SOP | XH29054-008 | 2 | 13C8_PFOS | M-03 |
| PFAS by ID SOP | XH29054-008 | 2 | 13C9_PFNA | M-03 |
| PFAS by ID SOP | XH29054-008 | 2 | d3-MeFOSAA | M-03 |
| PFAS by ID SOP | XH29054-009 | 1 | Perfluoro-1-octanesulfonamide (PFOSA) | M-03 |
| PFAS by ID SOP | XH29054-009 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-009 | 2 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-009 | 2 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-009 | 2 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-009 | 2 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-009 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH29054-018 | 1 | 1H, 1H, 2H, 2H-perfluorodecane | M-03 |
| PFAS by ID SOP | XH29054-018 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-018 | 1 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH29054-018 | 2 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-018 | 2 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-018 | 2 | Perfluoro-n-butanoic acid (PFBA) | M-03 |
| PFAS by ID SOP | XH29054-018 | 2 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-018 | 2 | Perfluoro-n-nonanoic acid (PFNA) | M-03 |
| PFAS by ID SOP | XH29054-018 | 2 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-018 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH29054-018 | 3 | 1H, 1H, 2H, 2H-perfluorodecane | M-03 |
| PFAS by ID SOP | XH29054-018 | 3 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-018 | 3 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-018 | 3 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH29054-018 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH29054-019 | 1 | Perfluoro-n-butanoic acid (PFBA) | M-03 |
| PFAS by ID SOP | XH29054-019 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-019 | 2 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-019 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| PFAS by ID SOP | XH29054-019 | 2 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-019 | 2 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-019 | 2 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

### Lot Number: XH29054

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| PFAS by ID SOP | XH29054-019 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH29054-019 | 2 | 13C2_8:2FTS | M-03 |
| PFAS by ID SOP | XH29054-019 | 2 | 13C6_PFDA | M-03 |
| PFAS by ID SOP | XH29054-019 | 3 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-019 | 3 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-019 | 3 | Perfluoro-n-heptanoic acid (PFHpA) | M-03 |
| PFAS by ID SOP | XH29054-019 | 3 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-019 | 3 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-019 | 3 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XH29054-019 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XH29054-020 | 1 | 1H, 1H, 2H, 2H-perfluorooctane sulfonic | M-03 |
| PFAS by ID SOP | XH29054-020 | 1 | Perfluoro-1-pentanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-020 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-020 | 1 | 13C2_PFTeDA | M-03 |
| PFAS by ID SOP | XH29054-021 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XH29054-021 | 1 | Perfluoro-n-butanoic acid (PFBA) | M-03 |
| PFAS by ID SOP | XH29054-021 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-021 | 1 | Perfluoro-n-nonanoic acid (PFNA) | M-03 |
| PFAS by ID SOP | XH29054-022 | 1 | Perfluoro-1-butanesulfonic acid (PFBS) | M-03 |
| PFAS by ID SOP | XH29054-022 | 1 | Perfluoro-1-octanesulfonamide (PFOSA) | M-03 |
| PFAS by ID SOP | XH29054-022 | 1 | Perfluoro-n-hexanoic acid (PFHxA) | M-03 |
| PFAS by ID SOP | XH29054-022 | 1 | Perfluoro-n-octanoic acid (PFOA) | M-03 |
| PFAS by ID SOP | XH29054-022 | 1 | Perfluoro-n-pentanoic acid (PFPeA) | M-03 |
| PFAS by ID SOP | XQ53996-002 | 1 | N-ethylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ53996-002 | 1 | N-methylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ53996-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | N-ethylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | N-methylperfluoro-1-octanesulfonamide | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | N-methylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | Perfluoro-1-heptanesulfonic acid | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | Perfluoro-1-octanesulfonamide (PFOSA) | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | Perfluoro-n-undecanoic acid (PFUdA) | M-03 |
| PFAS by ID SOP | XQ54228-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XQ54257-002 | 1 | N-methylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ54257-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| PFAS by ID SOP | XQ56292-002 | 1 | 1H, 1H, 2H, 2H-perfluorodecane | M-03 |
| PFAS by ID SOP | XQ56292-001 | 1 | 1H, 1H, 2H, 2H-perfluorooctane sulfonic | M-03 |
| PFAS by ID SOP | XQ56292-002 | 1 | N-ethylperfluoro-1- | M-03 |
| PFAS by ID SOP | XQ56292-002 | 1 | N-methylperfluoro-1- | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

### Lot Number: XH29054

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| PFAS by ID SOP | XQ56292-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

## Sample Summary
## Arcadis U.S., Inc.
Lot Number: XH29054

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | VRTB-D-M5_08222022 | Aqueous | 08/22/2022 1330 | 08/29/2022 |
| 002 | VRTB-D-06_08222022 | Aqueous | 08/22/2022 1500 | 08/29/2022 |
| 003 | VRTB-D-R7_08222022 | Aqueous | 08/22/2022 1600 | 08/29/2022 |
| 004 | VRTB-D-P8_08222022 | Aqueous | 08/22/2022 1705 | 08/29/2022 |
| 005 | Dup-01_08222022 | Aqueous | 08/22/2022 | 08/29/2022 |
| 006 | VRTB-S-B1_08222022 | Aqueous | 08/22/2022 1800 | 08/29/2022 |
| 007 | VRTB-S-S2_08222022 | Aqueous | 08/22/2022 1835 | 08/29/2022 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | 08/23/2022 0920 | 08/29/2022 |
| 009 | VRTB-S-G4_08232022 | Aqueous | 08/23/2022 1015 | 08/29/2022 |
| 010 | VRTB-L-B1_08232022 | Aqueous | 08/23/2022 1240 | 08/29/2022 |
| 011 | VRTB-L-S2_08232022 | Aqueous | 08/23/2022 1325 | 08/29/2022 |
| 012 | VRTB-L-Y3_08232022 | Aqueous | 08/23/2022 1420 | 08/29/2022 |
| 013 | VRTB-L-G4_08232022 | Aqueous | 08/23/2022 1510 | 08/29/2022 |
| 014 | VRTB-L-M5_08232022 | Aqueous | 08/23/2022 1620 | 08/29/2022 |
| 015 | VRTB-L-06_08232022 | Aqueous | 08/23/2022 1710 | 08/29/2022 |
| 016 | VRTB-L-P7_08232022 | Aqueous | 08/23/2022 1800 | 08/29/2022 |
| 017 | VRTB-L-BB8_08232022 | Aqueous | 08/23/2022 1840 | 08/29/2022 |
| 018 | VRTB-D-B1_08242022 | Aqueous | 08/24/2022 0915 | 08/29/2022 |
| 019 | VRTB-D-S2_08242022 | Aqueous | 08/24/2022 0950 | 08/29/2022 |
| 020 | Dup-02_08242022 | Aqueous | 08/24/2022 | 08/29/2022 |
| 021 | VRTB-D-Y3_08242022 | Aqueous | 08/24/2022 1045 | 08/29/2022 |
| 022 | VRTB-D-G4_08242022 | Aqueous | 08/24/2022 1130 | 08/29/2022 |

(22 samples)

# Detection Summary

## Arcadis U.S., Inc.

### Lot Number: XH29054

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | VRTB-D-M5_08222022 | Aqueous | PFBS | PFAS by ID | 4.8 | | ng/L | 16 |
| 001 | VRTB-D-M5_08222022 | Aqueous | PFHpS | PFAS by ID | 2.6 | J | ng/L | 16 |
| 001 | VRTB-D-M5_08222022 | Aqueous | PFPeS | PFAS by ID | 5.7 | | ng/L | 16 |
| 001 | VRTB-D-M5_08222022 | Aqueous | PFHxS | PFAS by ID | 83 | | ng/L | 16 |
| 001 | VRTB-D-M5_08222022 | Aqueous | PFBA | PFAS by ID | 6.4 | | ng/L | 16 |
| 001 | VRTB-D-M5_08222022 | Aqueous | PFHpA | PFAS by ID | 4.7 | | ng/L | 16 |
| 001 | VRTB-D-M5_08222022 | Aqueous | PFHxA | PFAS by ID | 14 | M-03 | ng/L | 16 |
| 001 | VRTB-D-M5_08222022 | Aqueous | PFOA | PFAS by ID | 4.0 | M-03 | ng/L | 16 |
| 001 | VRTB-D-M5_08222022 | Aqueous | PFPeA | PFAS by ID | 15 | M-03 | ng/L | 16 |
| 001 | VRTB-D-M5_08222022 | Aqueous | PFOS | PFAS by ID | 230 | | ng/L | 16 |
| 002 | VRTB-D-06_08222022 | Aqueous | PFBS | PFAS by ID | 2.4 | J | ng/L | 18 |
| 002 | VRTB-D-06_08222022 | Aqueous | PFHpS | PFAS by ID | 4.8 | | ng/L | 18 |
| 002 | VRTB-D-06_08222022 | Aqueous | PFPeS | PFAS by ID | 4.5 | M-03 | ng/L | 18 |
| 002 | VRTB-D-06_08222022 | Aqueous | PFHxS | PFAS by ID | 79 | | ng/L | 18 |
| 002 | VRTB-D-06_08222022 | Aqueous | PFBA | PFAS by ID | 4.8 | | ng/L | 18 |
| 002 | VRTB-D-06_08222022 | Aqueous | PFHpA | PFAS by ID | 5.1 | | ng/L | 18 |
| 002 | VRTB-D-06_08222022 | Aqueous | PFHxA | PFAS by ID | 9.4 | M-03 | ng/L | 18 |
| 002 | VRTB-D-06_08222022 | Aqueous | PFNA | PFAS by ID | 0.92 | JM-03 | ng/L | 18 |
| 002 | VRTB-D-06_08222022 | Aqueous | PFOA | PFAS by ID | 6.1 | M-03 | ng/L | 18 |
| 002 | VRTB-D-06_08222022 | Aqueous | PFPeA | PFAS by ID | 8.7 | M-03 | ng/L | 18 |
| 002 | VRTB-D-06_08222022 | Aqueous | PFOS | PFAS by ID | 240 | M-03 | ng/L | 18 |
| 003 | VRTB-D-R7_08222022 | Aqueous | PFBS | PFAS by ID | 2.7 | J | ng/L | 20 |
| 003 | VRTB-D-R7_08222022 | Aqueous | PFHpS | PFAS by ID | 1.0 | J | ng/L | 20 |
| 003 | VRTB-D-R7_08222022 | Aqueous | PFPeS | PFAS by ID | 1.5 | J | ng/L | 20 |
| 003 | VRTB-D-R7_08222022 | Aqueous | PFHxS | PFAS by ID | 46 | | ng/L | 20 |
| 003 | VRTB-D-R7_08222022 | Aqueous | PFBA | PFAS by ID | 8.6 | | ng/L | 20 |
| 003 | VRTB-D-R7_08222022 | Aqueous | PFHpA | PFAS by ID | 9.9 | | ng/L | 20 |
| 003 | VRTB-D-R7_08222022 | Aqueous | PFHxA | PFAS by ID | 12 | M-03 | ng/L | 20 |
| 003 | VRTB-D-R7_08222022 | Aqueous | PFNA | PFAS by ID | 0.95 | J | ng/L | 20 |
| 003 | VRTB-D-R7_08222022 | Aqueous | PFOA | PFAS by ID | 5.5 | M-03 | ng/L | 20 |
| 003 | VRTB-D-R7_08222022 | Aqueous | PFPeA | PFAS by ID | 17 | | ng/L | 20 |
| 003 | VRTB-D-R7_08222022 | Aqueous | PFOS | PFAS by ID | 81 | | ng/L | 20 |
| 004 | VRTB-D-P8_08222022 | Aqueous | PFBS | PFAS by ID | 6.2 | | ng/L | 22 |
| 004 | VRTB-D-P8_08222022 | Aqueous | PFHpS | PFAS by ID | 2.6 | J | ng/L | 22 |
| 004 | VRTB-D-P8_08222022 | Aqueous | PFPeS | PFAS by ID | 2.5 | JM-03 | ng/L | 22 |
| 004 | VRTB-D-P8_08222022 | Aqueous | PFHxS | PFAS by ID | 83 | M-03 | ng/L | 22 |
| 004 | VRTB-D-P8_08222022 | Aqueous | PFBA | PFAS by ID | 13 | M-03 | ng/L | 22 |
| 004 | VRTB-D-P8_08222022 | Aqueous | PFHpA | PFAS by ID | 23 | | ng/L | 22 |
| 004 | VRTB-D-P8_08222022 | Aqueous | PFHxA | PFAS by ID | 21 | | ng/L | 22 |
| 004 | VRTB-D-P8_08222022 | Aqueous | PFNA | PFAS by ID | 4.3 | | ng/L | 22 |
| 004 | VRTB-D-P8_08222022 | Aqueous | PFOA | PFAS by ID | 19 | M-03 | ng/L | 22 |
| 004 | VRTB-D-P8_08222022 | Aqueous | PFPeA | PFAS by ID | 25 | | ng/L | 22 |
| 004 | VRTB-D-P8_08222022 | Aqueous | PFOS | PFAS by ID | 180 | M-03 | ng/L | 22 |
| 005 | Dup-01_08222022 | Aqueous | PFBS | PFAS by ID | 7.6 | | ng/L | 24 |
| 005 | Dup-01_08222022 | Aqueous | PFHpS | PFAS by ID | 3.5 | J | ng/L | 24 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 005 | Dup-01_08222022 | Aqueous | PFPeS | PFAS by ID | 3.2 | JM-03 | ng/L | 24 |
| 005 | Dup-01_08222022 | Aqueous | PFHxS | PFAS by ID | 110 | M-03 | ng/L | 24 |
| 005 | Dup-01_08222022 | Aqueous | PFBA | PFAS by ID | 16 | | ng/L | 24 |
| 005 | Dup-01_08222022 | Aqueous | PFHpA | PFAS by ID | 32 | | ng/L | 24 |
| 005 | Dup-01_08222022 | Aqueous | PFHxA | PFAS by ID | 27 | M-03 | ng/L | 24 |
| 005 | Dup-01_08222022 | Aqueous | PFNA | PFAS by ID | 5.5 | | ng/L | 24 |
| 005 | Dup-01_08222022 | Aqueous | PFOA | PFAS by ID | 25 | M-03 | ng/L | 24 |
| 005 | Dup-01_08222022 | Aqueous | PFPeA | PFAS by ID | 32 | | ng/L | 24 |
| 005 | Dup-01_08222022 | Aqueous | PFOS | PFAS by ID | 220 | M-03 | ng/L | 24 |
| 006 | VRTB-S-B1_08222022 | Aqueous | PFBS | PFAS by ID | 2.8 | JM-03 | ng/L | 26 |
| 006 | VRTB-S-B1_08222022 | Aqueous | PFHpS | PFAS by ID | 1.1 | JM-03 | ng/L | 26 |
| 006 | VRTB-S-B1_08222022 | Aqueous | PFOSA | PFAS by ID | 3.9 | J | ng/L | 26 |
| 006 | VRTB-S-B1_08222022 | Aqueous | PFPeS | PFAS by ID | 2.1 | JM-03 | ng/L | 26 |
| 006 | VRTB-S-B1_08222022 | Aqueous | PFHxS | PFAS by ID | 34 | M-03 | ng/L | 26 |
| 006 | VRTB-S-B1_08222022 | Aqueous | PFBA | PFAS by ID | 2.7 | J | ng/L | 26 |
| 006 | VRTB-S-B1_08222022 | Aqueous | PFHpA | PFAS by ID | 1.3 | JM-03 | ng/L | 26 |
| 006 | VRTB-S-B1_08222022 | Aqueous | PFHxA | PFAS by ID | 2.4 | JM-03 | ng/L | 26 |
| 006 | VRTB-S-B1_08222022 | Aqueous | PFOA | PFAS by ID | 2.1 | JM-03 | ng/L | 26 |
| 006 | VRTB-S-B1_08222022 | Aqueous | PFPeA | PFAS by ID | 2.4 | J | ng/L | 26 |
| 006 | VRTB-S-B1_08222022 | Aqueous | PFOS | PFAS by ID | 240 | M-03 | ng/L | 26 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFBS | PFAS by ID | 4.2 | | ng/L | 28 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFHpS | PFAS by ID | 7.5 | M-03 | ng/L | 28 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFOSA | PFAS by ID | 3.0 | J | ng/L | 28 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFPeS | PFAS by ID | 6.7 | M-03 | ng/L | 28 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFHxS | PFAS by ID | 160 | M-03 | ng/L | 28 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFBA | PFAS by ID | 15 | M-03 | ng/L | 28 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFHpA | PFAS by ID | 25 | | ng/L | 28 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFHxA | PFAS by ID | 22 | M-03 | ng/L | 28 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFNA | PFAS by ID | 7.7 | | ng/L | 28 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFOA | PFAS by ID | 44 | M-03 | ng/L | 28 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFPeA | PFAS by ID | 16 | | ng/L | 28 |
| 007 | VRTB-S-S2_08222022 | Aqueous | PFOS | PFAS by ID | 870 | | ng/L | 28 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | 8:2 FTS | PFAS by ID | 2.7 | JM-03 | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFBS | PFAS by ID | 9.4 | | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFHpS | PFAS by ID | 27 | | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFOSA | PFAS by ID | 3.8 | J | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFPeS | PFAS by ID | 19 | M-03 | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFHxS | PFAS by ID | 610 | | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFBA | PFAS by ID | 12 | | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFHpA | PFAS by ID | 15 | M-03 | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFHxA | PFAS by ID | 33 | M-03 | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFNA | PFAS by ID | 6.7 | | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFOA | PFAS by ID | 28 | M-03 | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFPeA | PFAS by ID | 19 | | ng/L | 30 |
| 008 | VRTB-S-Y3_08232022 | Aqueous | PFOS | PFAS by ID | 1600 | M-03 | ng/L | 30 |
| 009 | VRTB-S-G4_08232022 | Aqueous | PFBS | PFAS by ID | 10 | | ng/L | 32 |
| 009 | VRTB-S-G4_08232022 | Aqueous | PFHpS | PFAS by ID | 11 | | ng/L | 32 |
| 009 | VRTB-S-G4_08232022 | Aqueous | PFPeS | PFAS by ID | 17 | | ng/L | 32 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 009 | VRTB-S-G4_08232022 | Aqueous | PFBA | PFAS by ID | 5.6 | | ng/L | 32 |
| 009 | VRTB-S-G4_08232022 | Aqueous | PFHpA | PFAS by ID | 5.7 | | ng/L | 32 |
| 009 | VRTB-S-G4_08232022 | Aqueous | PFHxA | PFAS by ID | 14 | M-03 | ng/L | 32 |
| 009 | VRTB-S-G4_08232022 | Aqueous | PFNA | PFAS by ID | 1.6 | J | ng/L | 32 |
| 009 | VRTB-S-G4_08232022 | Aqueous | PFOA | PFAS by ID | 9.5 | | ng/L | 32 |
| 009 | VRTB-S-G4_08232022 | Aqueous | PFPeA | PFAS by ID | 5.8 | | ng/L | 32 |
| 009 | VRTB-S-G4_08232022 | Aqueous | PFHxS | PFAS by ID | 360 | H | ng/L | 34 |
| 009 | VRTB-S-G4_08232022 | Aqueous | PFOS | PFAS by ID | 760 | HM-03 | ng/L | 34 |
| 018 | VRTB-D-B1_08242022 | Aqueous | 8:2 FTS | PFAS by ID | 5.1 | JM-03 | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | 6:2 FTS | PFAS by ID | 6.3 | JQ | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | PFBS | PFAS by ID | 9.8 | | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | PFHpS | PFAS by ID | 12 | | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | PFPeS | PFAS by ID | 14 | | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | PFHxS | PFAS by ID | 290 | | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | PFBA | PFAS by ID | 17 | | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | PFHpA | PFAS by ID | 24 | | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | PFHxA | PFAS by ID | 36 | M-03 | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | PFNA | PFAS by ID | 6.5 | | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | PFOA | PFAS by ID | 35 | | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | PFPeA | PFAS by ID | 26 | M-03 | ng/L | 36 |
| 018 | VRTB-D-B1_08242022 | Aqueous | PFOS | PFAS by ID | 1500 | HM-03 | ng/L | 38 |
| 019 | VRTB-D-S2_08242022 | Aqueous | PFOS | PFAS by ID | 330 | HQM-03 | ng/L | 44 |
| 019 | VRTB-D-S2_08242022 | Aqueous | PFBS | PFAS by ID | 20 | H | ng/L | 46 |
| 019 | VRTB-D-S2_08242022 | Aqueous | PFHpS | PFAS by ID | 5.2 | HM-03 | ng/L | 46 |
| 019 | VRTB-D-S2_08242022 | Aqueous | PFPeS | PFAS by ID | 35 | HM-03 | ng/L | 46 |
| 019 | VRTB-D-S2_08242022 | Aqueous | PFHxS | PFAS by ID | 150 | H | ng/L | 46 |
| 019 | VRTB-D-S2_08242022 | Aqueous | PFBA | PFAS by ID | 5.8 | H | ng/L | 46 |
| 019 | VRTB-D-S2_08242022 | Aqueous | PFHpA | PFAS by ID | 5.7 | HM-03 | ng/L | 46 |
| 019 | VRTB-D-S2_08242022 | Aqueous | PFHxA | PFAS by ID | 14 | HM-03 | ng/L | 46 |
| 019 | VRTB-D-S2_08242022 | Aqueous | PFNA | PFAS by ID | 1.5 | HJ | ng/L | 46 |
| 019 | VRTB-D-S2_08242022 | Aqueous | PFOA | PFAS by ID | 16 | HM-03 | ng/L | 46 |
| 019 | VRTB-D-S2_08242022 | Aqueous | PFPeA | PFAS by ID | 10 | HM-03 | ng/L | 46 |
| 020 | Dup-02_08242022 | Aqueous | PFBS | PFAS by ID | 18 | | ng/L | 48 |
| 020 | Dup-02_08242022 | Aqueous | PFHpS | PFAS by ID | 5.9 | | ng/L | 48 |
| 020 | Dup-02_08242022 | Aqueous | PFPeS | PFAS by ID | 32 | M-03 | ng/L | 48 |
| 020 | Dup-02_08242022 | Aqueous | PFHxS | PFAS by ID | 160 | | ng/L | 48 |
| 020 | Dup-02_08242022 | Aqueous | PFBA | PFAS by ID | 6.7 | | ng/L | 48 |
| 020 | Dup-02_08242022 | Aqueous | PFHpA | PFAS by ID | 5.5 | | ng/L | 48 |
| 020 | Dup-02_08242022 | Aqueous | PFHxA | PFAS by ID | 14 | M-03 | ng/L | 48 |
| 020 | Dup-02_08242022 | Aqueous | PFNA | PFAS by ID | 1.5 | J | ng/L | 48 |
| 020 | Dup-02_08242022 | Aqueous | PFOA | PFAS by ID | 14 | | ng/L | 48 |
| 020 | Dup-02_08242022 | Aqueous | PFPeA | PFAS by ID | 9.9 | | ng/L | 48 |
| 020 | Dup-02_08242022 | Aqueous | PFOS | PFAS by ID | 300 | | ng/L | 48 |
| 021 | VRTB-D-Y3_08242022 | Aqueous | PFBS | PFAS by ID | 4.1 | | ng/L | 50 |
| 021 | VRTB-D-Y3_08242022 | Aqueous | PFHpS | PFAS by ID | 1.5 | JM-03 | ng/L | 50 |
| 021 | VRTB-D-Y3_08242022 | Aqueous | PFPeS | PFAS by ID | 7.4 | | ng/L | 50 |
| 021 | VRTB-D-Y3_08242022 | Aqueous | PFHxS | PFAS by ID | 63 | | ng/L | 50 |
| 021 | VRTB-D-Y3_08242022 | Aqueous | PFBA | PFAS by ID | 3.7 | M-03 | ng/L | 50 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 021 | VRTB-D-Y3_08242022 | Aqueous | PFHpA | PFAS by ID | 2.6 | J | ng/L | 50 |
| 021 | VRTB-D-Y3_08242022 | Aqueous | PFHxA | PFAS by ID | 4.4 | M-03 | ng/L | 50 |
| 021 | VRTB-D-Y3_08242022 | Aqueous | PFOA | PFAS by ID | 5.0 | | ng/L | 50 |
| 021 | VRTB-D-Y3_08242022 | Aqueous | PFPeA | PFAS by ID | 3.8 | | ng/L | 50 |
| 021 | VRTB-D-Y3_08242022 | Aqueous | PFOS | PFAS by ID | 130 | | ng/L | 50 |
| 022 | VRTB-D-G4_08242022 | Aqueous | PFBS | PFAS by ID | 0.95 | JM-03 | ng/L | 52 |
| 022 | VRTB-D-G4_08242022 | Aqueous | PFHpS | PFAS by ID | 1.3 | J | ng/L | 52 |
| 022 | VRTB-D-G4_08242022 | Aqueous | PFPeS | PFAS by ID | 1.4 | J | ng/L | 52 |
| 022 | VRTB-D-G4_08242022 | Aqueous | PFHxS | PFAS by ID | 39 | | ng/L | 52 |
| 022 | VRTB-D-G4_08242022 | Aqueous | PFBA | PFAS by ID | 5.8 | | ng/L | 52 |
| 022 | VRTB-D-G4_08242022 | Aqueous | PFHpA | PFAS by ID | 3.5 | | ng/L | 52 |
| 022 | VRTB-D-G4_08242022 | Aqueous | PFHxA | PFAS by ID | 12 | M-03 | ng/L | 52 |
| 022 | VRTB-D-G4_08242022 | Aqueous | PFOA | PFAS by ID | 3.4 | M-03 | ng/L | 52 |
| 022 | VRTB-D-G4_08242022 | Aqueous | PFPeA | PFAS by ID | 14 | M-03 | ng/L | 52 |
| 022 | VRTB-D-G4_08242022 | Aqueous | PFOS | PFAS by ID | 84 | | ng/L | 52 |

(156 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-001
Description: VRTB-D-M5_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022 1330
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/20/2022 2326 | MMM | 09/13/2022 1209 | 53996 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.8 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.6 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 5.7 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 83 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.4 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 4.7 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 14 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 4.0 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 15 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 230 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 127 | 50-150 |
| 13C2_6:2FTS | N | 211 | 50-150 |
| 13C2_8:2FTS | | 113 | 50-150 |
| 13C2_PFDoA | | 100 | 50-150 |
| 13C2_PFTeDA | | 90 | 50-150 |
| 13C3_PFBS | | 104 | 50-150 |
| 13C3_PFHxS | | 109 | 50-150 |
| 13C4_PFBA | | 105 | 50-150 |
| 13C4_PFHpA | | 108 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 110 | 50-150 |
| 13C6_PFDA | | 107 | 50-150 |
| 13C7_PFUdA | | 100 | 50-150 |
| 13C8_PFOA | | 105 | 50-150 |
| 13C8_PFOS | | 102 | 50-150 |
| 13C8_PFOSA | | 116 | 50-150 |
| 13C9_PFNA | | 106 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-001
Description: VRTB-D-M5_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022 1330
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 108 | 50-150 |
| d-MeFOSA | | 93 | 50-150 |
| d3-MeFOSAA | | 115 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-002
Description: VRTB-D-06_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022 1500
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/20/2022 2337 | MMM | 09/13/2022 1209 | 53996 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.4 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 4.8 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 4.5 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 79 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 4.8 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 5.1 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 9.4 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.92 | JM-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 6.1 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 8.7 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 240 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 132 | 50-150 |
| 13C2_6:2FTS | N | 190 | 50-150 |
| 13C2_8:2FTS | | 117 | 50-150 |
| 13C2_PFDoA | | 101 | 50-150 |
| 13C2_PFTeDA | | 66 | 50-150 |
| 13C3_PFBS | | 110 | 50-150 |
| 13C3_PFHxS | | 106 | 50-150 |
| 13C4_PFBA | | 103 | 50-150 |
| 13C4_PFHpA | | 110 | 50-150 |
| 13C5_PFHxA | | 102 | 50-150 |
| 13C5_PFPeA | | 106 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 |
| 13C7_PFUdA | | 104 | 50-150 |
| 13C8_PFOA | | 105 | 50-150 |
| 13C8_PFOS | | 102 | 50-150 |
| 13C8_PFOSA | | 116 | 50-150 |
| 13C9_PFNA | | 105 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-002
Description: VRTB-D-06_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022 1500
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 109 | 50-150 |
| d-MeFOSA | | 92 | 50-150 |
| d3-MeFOSAA | | 117 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-003
Description: VRTB-D-R7_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022 1600
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/20/2022 2348 | MMM | 09/13/2022 1209 | 53996 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 7.0 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.7 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.0 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.5 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 46 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 8.6 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 9.9 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 12 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 0.95 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 5.5 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 17 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 81 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 131 | 50-150 |
| 13C2_6:2FTS | N | 171 | 50-150 |
| 13C2_8:2FTS | | 111 | 50-150 |
| 13C2_PFDoA | | 88 | 50-150 |
| 13C2_PFTeDA | | 62 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 |
| 13C3_PFHxS | | 103 | 50-150 |
| 13C4_PFBA | | 97 | 50-150 |
| 13C4_PFHpA | | 105 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 98 | 50-150 |
| 13C7_PFUdA | | 90 | 50-150 |
| 13C8_PFOA | | 101 | 50-150 |
| 13C8_PFOS | | 97 | 50-150 |
| 13C8_PFOSA | | 105 | 50-150 |
| 13C9_PFNA | | 97 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-003
Description: VRTB-D-R7_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022 1600
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 100 | 50-150 |
| d-MeFOSA | | 79 | 50-150 |
| d3-MeFOSAA | | 108 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH29054-004
Description: VRTB-D-P8_08222022 | Matrix: Aqueous
Date Sampled: 08/22/2022 1705
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/29/2022 1555 | ALM | 09/15/2022 1102 | 54228 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.7 | U | 7.4 | 3.7 | 1.9 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.7 | UQ | 7.4 | 3.7 | 1.9 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.7 | U | 7.4 | 3.7 | 1.9 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.7 | U | 7.4 | 3.7 | 1.9 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.5 | U | 15 | 7.5 | 3.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.7 | U | 7.4 | 3.7 | 1.9 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 6.2 | | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 2.6 | J | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.5 | JM-03 | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 83 | M-03 | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 13 | M-03 | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 23 | | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 21 | | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 4.3 | | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 19 | M-03 | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 25 | | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.9 | U | 3.7 | 1.9 | 0.93 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 180 | M-03 | 3.7 | 1.9 | 0.93 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 106 | 50-150 |
| 13C2_6:2FTS | N | 191 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 |
| 13C2_PFDoA | | 70 | 50-150 |
| 13C2_PFTeDA | | 52 | 50-150 |
| 13C3_PFBS | | 90 | 50-150 |
| 13C3_PFHxS | | 87 | 50-150 |
| 13C4_PFBA | | 70 | 50-150 |
| 13C4_PFHpA | | 89 | 50-150 |
| 13C5_PFHxA | | 91 | 50-150 |
| 13C5_PFPeA | | 87 | 50-150 |
| 13C6_PFDA | | 85 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 90 | 50-150 |
| 13C8_PFOS | | 86 | 50-150 |
| 13C8_PFOSA | | 80 | 50-150 |
| 13C9_PFNA | | 90 | 50-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-004
Description: VRTB-D-P8_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022 1705
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 79 | 50-150 |
| d-MeFOSA | | 71 | 50-150 |
| d3-MeFOSAA | | 84 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-005
Description: Dup-01_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/29/2022 1605 | ALM | 09/15/2022 1102 | 54228 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.8 | U | 9.6 | 4.8 | 2.4 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.8 | U | 9.6 | 4.8 | 2.4 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.8 | U | 9.6 | 4.8 | 2.4 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.8 | U | 9.6 | 4.8 | 2.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 9.5 | U | 19 | 9.5 | 4.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.8 | U | 9.6 | 4.8 | 2.4 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 7.6 | | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.4 | U | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 3.5 | J | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.4 | U | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 2.4 | U | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 3.2 | JM-03 | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 110 | M-03 | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 16 | | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.4 | U | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.4 | U | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 32 | | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 27 | M-03 | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 5.5 | | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 25 | M-03 | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 32 | | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.4 | UQ | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.4 | U | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.4 | U | 4.8 | 2.4 | 1.2 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 220 | M-03 | 4.8 | 2.4 | 1.2 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 76 | 50-150 |
| 13C2_6:2FTS | | 142 | 50-150 |
| 13C2_8:2FTS | | 77 | 50-150 |
| 13C2_PFDoA | | 53 | 50-150 |
| 13C2_PFTeDA | N | 38 | 50-150 |
| 13C3_PFBS | | 67 | 50-150 |
| 13C3_PFHxS | | 65 | 50-150 |
| 13C4_PFBA | | 62 | 50-150 |
| 13C4_PFHpA | | 65 | 50-150 |
| 13C5_PFHxA | | 69 | 50-150 |
| 13C5_PFPeA | | 66 | 50-150 |
| 13C6_PFDA | | 68 | 50-150 |
| 13C7_PFUdA | | 60 | 50-150 |
| 13C8_PFOA | | 66 | 50-150 |
| 13C8_PFOS | | 71 | 50-150 |
| 13C8_PFOSA | | 62 | 50-150 |
| 13C9_PFNA | | 69 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-005
Description: Dup-01_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 58 | 50-150 |
| d-MeFOSA | | 57 | 50-150 |
| d3-MeFOSAA | | 63 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: XH29054-006
Description: VRTB-S-B1_08222022 | Matrix: Aqueous
Date Sampled: 08/22/2022 1800
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/29/2022 1616 | ALM | 09/15/2022 1102 | 54228 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 4.3 | U | 8.5 | 4.3 | 2.1 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.3 | UQM-03 | 8.5 | 4.3 | 2.1 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 4.3 | U | 8.5 | 4.3 | 2.1 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 4.3 | U | 8.5 | 4.3 | 2.1 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 8.5 | UQ | 17 | 8.5 | 4.3 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 4.3 | U | 8.5 | 4.3 | 2.1 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 2.8 | JM-03 | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.2 | U | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.1 | JM-03 | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.2 | U | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 3.9 | J | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 2.1 | JM-03 | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 34 | M-03 | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 2.7 | J | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.2 | U | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.2 | UQ | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 1.3 | JM-03 | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 2.4 | JM-03 | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 2.2 | UM-03 | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 2.1 | JM-03 | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 2.4 | J | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.2 | UQ | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.2 | UQ | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.2 | U | 4.3 | 2.2 | 1.1 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 240 | M-03 | 4.3 | 2.2 | 1.1 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 99 | 50-150 |
| 13C2_6:2FTS | N | 174 | 50-150 |
| 13C2_8:2FTS | | 79 | 50-150 |
| 13C2_PFDoA | N | 39 | 50-150 |
| 13C2_PFTeDA | N | 35 | 50-150 |
| 13C3_PFBS | | 81 | 50-150 |
| 13C3_PFHxS | | 80 | 50-150 |
| 13C4_PFBA | | 80 | 50-150 |
| 13C4_PFHpA | | 77 | 50-150 |
| 13C5_PFHxA | | 82 | 50-150 |
| 13C5_PFPeA | | 82 | 50-150 |
| 13C6_PFDA | | 72 | 50-150 |
| 13C7_PFUdA | | 54 | 50-150 |
| 13C8_PFOA | | 77 | 50-150 |
| 13C8_PFOS | | 76 | 50-150 |
| 13C8_PFOSA | | 69 | 50-150 |
| 13C9_PFNA | | 79 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-006
Description: VRTB-S-B1_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022 1800
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 57 | 50-150 |
| d-MeFOSA | N | 34 | 50-150 |
| d3-MeFOSAA | | 61 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-007
Description: VRTB-S-S2_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022 1835
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/29/2022 1627 | ALM | 09/15/2022 1102 | 54228 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 09/30/2022 2024 | ALM | 09/15/2022 1102 | 54228 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQM-03 | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UQ | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.2 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 7.5 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 3.0 | J | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 6.7 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 160 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 15 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 25 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 22 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 7.7 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 44 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 16 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 870 | | 17 | 8.5 | 4.3 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 128 | 50-150 | | 109 | 50-150 |
| 13C2_6:2FTS | N | 196 | 50-150 | M-03 | 109 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 | | 99 | 50-150 |
| 13C2_PFDoA | M-03 | 50 | 50-150 | | 53 | 50-150 |
| 13C2_PFTeDA | N | 35 | 50-150 | N | 33 | 50-150 |
| 13C3_PFBS | | 96 | 50-150 | | 100 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 | | 110 | 50-150 |
| 13C4_PFBA | | 93 | 50-150 | | 101 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 | | 108 | 50-150 |
| 13C5_PFHxA | | 96 | 50-150 | | 90 | 50-150 |
| 13C5_PFPeA | | 103 | 50-150 | | 93 | 50-150 |
| 13C6_PFDA | | 90 | 50-150 | N | 12 | 50-150 |
| 13C7_PFUdA | | 71 | 50-150 | | 80 | 50-150 |
| 13C8_PFOA | | 89 | 50-150 | | 108 | 50-150 |
| 13C8_PFOS | | 88 | 50-150 | | 97 | 50-150 |
| 13C8_PFOSA | | 81 | 50-150 | | 77 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-007
Description: VRTB-S-S2_08222022
Matrix: Aqueous
Date Sampled: 08/22/2022 1835
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 88 | 50-150 | | 99 | 50-150 |
| d5-EtFOSAA | | 87 | 50-150 | | 89 | 50-150 |
| d-MeFOSA | N | 40 | 50-150 | N | 42 | 50-150 |
| d3-MeFOSAA | | 87 | 50-150 | | 90 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-008
Description: VRTB-S-Y3_08232022
Matrix: Aqueous
Date Sampled: 08/23/2022 0920
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/29/2022 1638 | ALM | 09/15/2022 1102 | 54228 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/04/2022 1132 | ALM | 09/15/2022 1102 | 54228 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 2.7 | JM-03 | 11 | 5.5 | 2.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 5.5 | U | 11 | 5.5 | 2.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 5.5 | U | 11 | 5.5 | 2.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 5.5 | U | 11 | 5.5 | 2.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 11 | UQ | 22 | 11 | 5.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 5.5 | U | 11 | 5.5 | 2.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.4 | | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 2.7 | U | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 27 | | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 2.7 | U | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 3.8 | J | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 19 | M-03 | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 610 | | 27 | 14 | 6.8 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 12 | | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 2.7 | U | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 2.7 | UQ | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 15 | M-03 | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 33 | M-03 | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 6.7 | | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 28 | M-03 | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 19 | | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 2.7 | UQ | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 2.7 | UQ | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 2.7 | U | 5.4 | 2.7 | 1.4 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1600 | M-03 | 27 | 14 | 6.8 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 78 | 50-150 | | 68 | 50-150 |
| 13C2_6:2FTS | | 140 | 50-150 | | 65 | 50-150 |
| 13C2_8:2FTS | | 71 | 50-150 | | 73 | 50-150 |
| 13C2_PFDoA | N | 41 | 50-150 | M-03N | 43 | 50-150 |
| 13C2_PFTeDA | N | 32 | 50-150 | N | 34 | 50-150 |
| 13C3_PFBS | | 65 | 50-150 | | 68 | 50-150 |
| 13C3_PFHxS | | 66 | 50-150 | | 71 | 50-150 |
| 13C4_PFBA | | 67 | 50-150 | | 69 | 50-150 |
| 13C4_PFHpA | | 65 | 50-150 | | 77 | 50-150 |
| 13C5_PFHxA | | 65 | 50-150 | | 72 | 50-150 |
| 13C5_PFPeA | | 68 | 50-150 | | 68 | 50-150 |
| 13C6_PFDA | | 62 | 50-150 | | 71 | 50-150 |
| 13C7_PFUdA | | 54 | 50-150 | M-03 | 53 | 50-150 |
| 13C8_PFOA | | 64 | 50-150 | | 73 | 50-150 |
| 13C8_PFOS | | 60 | 50-150 | M-03 | 79 | 50-150 |
| 13C8_PFOSA | | 61 | 50-150 | | 66 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-008
Description: VRTB-S-Y3_08232022
Matrix: Aqueous
Date Sampled: 08/23/2022 0920
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 62 | 50-150 | M-03 | 67 | 50-150 |
| d5-EtFOSAA | | 55 | 50-150 | | 54 | 50-150 |
| d-MeFOSA | N | 36 | 50-150 | N | 38 | 50-150 |
| d3-MeFOSAA | | 58 | 50-150 | M-03 | 64 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-009
Description: VRTB-S-G4_08232022
Matrix: Aqueous
Date Sampled: 08/23/2022 1015
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1755 | LAB | 09/15/2022 1253 | 54257 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/24/2022 1525 | ALM | 09/15/2022 1253 | 54257 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 10 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 11 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UM-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 17 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 350 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 5.6 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 5.7 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 14 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.6 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 9.5 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 5.8 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 750 | E | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 107 | 50-150 | H | 103 | 50-150 |
| 13C2_6:2FTS | N | 173 | 50-150 | H | 142 | 50-150 |
| 13C2_8:2FTS | | 99 | 50-150 | H | 117 | 50-150 |
| 13C2_PFDoA | | 93 | 50-150 | H | 89 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 | H | 85 | 50-150 |
| 13C3_PFBS | | 104 | 50-150 | H | 94 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 | H | 96 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 | H | 91 | 50-150 |
| 13C4_PFHpA | | 94 | 50-150 | H | 99 | 50-150 |
| 13C5_PFHxA | | 100 | 50-150 | H | 94 | 50-150 |
| 13C5_PFPeA | | 95 | 50-150 | H | 93 | 50-150 |
| 13C6_PFDA | | 86 | 50-150 | H | 95 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 | H | 88 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 | H | 94 | 50-150 |
| 13C8_PFOS | | 89 | 50-150 | H | 94 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 | H | 90 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-009
Description: VRTB-S-G4_08232022
Matrix: Aqueous
Date Sampled: 08/23/2022 1015
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 89 | 50-150 | H | 104 | 50-150 |
| d5-EtFOSAA | | 89 | 50-150 | H | 95 | 50-150 |
| d-MeFOSA | | 71 | 50-150 | H | 78 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 | H | 92 | 50-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-009
Description: VRTB-S-G4_08232022
Matrix: Aqueous
Date Sampled: 08/23/2022 1015
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1755 | LAB | 09/15/2022 1253 | 54257 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/24/2022 1525 | ALM | 09/15/2022 1253 | 54257 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 17 | UH | 34 | 17 | 8.6 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 17 | UH | 34 | 17 | 8.6 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 17 | UH | 34 | 17 | 8.6 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 17 | UH | 34 | 17 | 8.6 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 35 | UH | 69 | 35 | 17 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 17 | UH | 34 | 17 | 8.6 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 11 | HJ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 10 | HJM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 20 | HM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 360 | H | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 5.9 | HJ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 6.2 | HJ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 13 | HJM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 9.2 | HJM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 6.1 | HJ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 760 | HM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 107 | 50-150 | H | 103 | 50-150 |
| 13C2_6:2FTS | N | 173 | 50-150 | H | 142 | 50-150 |
| 13C2_8:2FTS | | 99 | 50-150 | H | 117 | 50-150 |
| 13C2_PFDoA | | 93 | 50-150 | H | 89 | 50-150 |
| 13C2_PFTeDA | | 79 | 50-150 | H | 85 | 50-150 |
| 13C3_PFBS | | 104 | 50-150 | H | 94 | 50-150 |
| 13C3_PFHxS | | 100 | 50-150 | H | 96 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 | H | 91 | 50-150 |
| 13C4_PFHpA | | 94 | 50-150 | H | 99 | 50-150 |
| 13C5_PFHxA | | 100 | 50-150 | H | 94 | 50-150 |
| 13C5_PFPeA | | 95 | 50-150 | H | 93 | 50-150 |
| 13C6_PFDA | | 86 | 50-150 | H | 95 | 50-150 |
| 13C7_PFUdA | | 87 | 50-150 | H | 88 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 | H | 94 | 50-150 |
| 13C8_PFOS | | 89 | 50-150 | H | 94 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 | H | 90 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-009
Description: VRTB-S-G4_08232022
Matrix: Aqueous
Date Sampled: 08/23/2022 1015
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C9_PFNA | | 89 | 50-150 | H | 104 | 50-150 |
| d5-EtFOSAA | | 89 | 50-150 | H | 95 | 50-150 |
| d-MeFOSA | | 71 | 50-150 | H | 78 | 50-150 |
| d3-MeFOSAA | | 88 | 50-150 | H | 92 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-018
Description: VRTB-D-B1_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0915
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1805 | LAB | 09/15/2022 1253 | 54257 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/19/2022 1454 | MMM | 09/15/2022 1253 | 54257 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2022 1844 | BWS | 10/06/2022 1957 | 56292 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 5.1 | JM-03 | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 6.3 | JQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.8 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 12 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 14 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 290 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 17 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 24 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 36 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 6.5 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 35 | | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 26 | M-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1400 | E | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Run 1 Acceptance Limits | Q | Run 2 % Recovery | Run 2 Acceptance Limits | Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 141 | 50-150 | H | 122 | 50-150 | H | 146 | 50-150 |
| 13C2_6:2FTS | N | 179 | 50-150 | H | 119 | 50-150 | HN | 212 | 50-150 |
| 13C2_8:2FTS | | 109 | 50-150 | H | 115 | 50-150 | H | 115 | 50-150 |
| 13C2_PFDoA | | 97 | 50-150 | H | 107 | 50-150 | H | 89 | 50-150 |
| 13C2_PFTeDA | | 54 | 50-150 | H | 79 | 50-150 | H | 57 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 | H | 114 | 50-150 | H | 98 | 50-150 |
| 13C3_PFHxS | | 102 | 50-150 | H | 118 | 50-150 | H | 91 | 50-150 |
| 13C4_PFBA | | 54 | 50-150 | H | 68 | 50-150 | H | 88 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 | H | 118 | 50-150 | H | 94 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 | H | 119 | 50-150 | H | 101 | 50-150 |
| 13C5_PFPeA | | 90 | 50-150 | H | 119 | 50-150 | H | 92 | 50-150 |
| 13C6_PFDA | | 94 | 50-150 | H | 125 | 50-150 | H | 95 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 | H | 120 | 50-150 | H | 92 | 50-150 |
| 13C8_PFOA | | 102 | 50-150 | H | 119 | 50-150 | H | 95 | 50-150 |
| 13C8_PFOS | | 85 | 50-150 | H | 108 | 50-150 | H | 88 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-018
Description: VRTB-D-B1_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0915
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 94 | 50-150 | H | 112 | 50-150 | H | 103 | 50-150 |
| 13C9_PFNA | | 88 | 50-150 | H | 117 | 50-150 | H | 87 | 50-150 |
| d5-EtFOSAA | | 96 | 50-150 | H | 112 | 50-150 | H | 108 | 50-150 |
| d-MeFOSA | | 76 | 50-150 | H | 106 | 50-150 | H | 114 | 50-150 |
| d3-MeFOSAA | | 103 | 50-150 | H | 115 | 50-150 | H | 105 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-018
Description: VRTB-D-B1_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0915
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1805 | LAB | 09/15/2022 1253 | 54257 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/19/2022 1454 | MMM | 09/15/2022 1253 | 54257 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2022 1844 | BWS | 10/06/2022 1957 | 56292 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 18 | UH | 35 | 18 | 8.7 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 18 | UH | 35 | 18 | 8.7 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 18 | UH | 35 | 18 | 8.7 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 18 | UH | 35 | 18 | 8.7 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 35 | UH | 69 | 35 | 17 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 18 | UH | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 9.7 | HJ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 12 | HJM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 18 | HM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 300 | H | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 15 | HJM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 25 | H | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 33 | HM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 6.4 | HJM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 34 | HM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 27 | H | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 8.5 | UH | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1500 | HM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 141 | 50-150 | H | 122 | 50-150 | H | 146 | 50-150 |
| 13C2_6:2FTS | N | 179 | 50-150 | H | 119 | 50-150 | HN | 212 | 50-150 |
| 13C2_8:2FTS | | 109 | 50-150 | H | 115 | 50-150 | H | 115 | 50-150 |
| 13C2_PFDoA | | 97 | 50-150 | H | 107 | 50-150 | H | 89 | 50-150 |
| 13C2_PFTeDA | | 54 | 50-150 | H | 79 | 50-150 | H | 57 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 | H | 114 | 50-150 | H | 98 | 50-150 |
| 13C3_PFHxS | | 102 | 50-150 | H | 118 | 50-150 | H | 91 | 50-150 |
| 13C4_PFBA | | 54 | 50-150 | H | 68 | 50-150 | H | 88 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 | H | 118 | 50-150 | H | 94 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 | H | 119 | 50-150 | H | 101 | 50-150 |
| 13C5_PFPeA | | 90 | 50-150 | H | 119 | 50-150 | H | 92 | 50-150 |
| 13C6_PFDA | | 94 | 50-150 | H | 125 | 50-150 | H | 95 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 | H | 120 | 50-150 | H | 92 | 50-150 |
| 13C8_PFOA | | 102 | 50-150 | H | 119 | 50-150 | H | 95 | 50-150 |
| 13C8_PFOS | | 85 | 50-150 | H | 108 | 50-150 | H | 88 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-018
Description: VRTB-D-B1_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0915
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 94 | 50-150 | H | 112 | 50-150 | H | 103 | 50-150 |
| 13C9_PFNA | | 88 | 50-150 | H | 117 | 50-150 | H | 87 | 50-150 |
| d5-EtFOSAA | | 96 | 50-150 | H | 112 | 50-150 | H | 108 | 50-150 |
| d-MeFOSA | | 76 | 50-150 | H | 106 | 50-150 | H | 114 | 50-150 |
| d3-MeFOSAA | | 103 | 50-150 | H | 115 | 50-150 | H | 105 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-018
Description: VRTB-D-B1_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0915
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1805 | LAB | 09/15/2022 1253 | 54257 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/19/2022 1454 | MMM | 09/15/2022 1253 | 54257 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2022 1844 | BWS | 10/06/2022 1957 | 56292 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 5.1 | HJM-03 | 7.1 | 3.6 | 1.8 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 4.9 | HJQ | 7.1 | 3.6 | 1.8 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.6 | UH | 7.1 | 3.6 | 1.8 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | UH | 7.1 | 3.6 | 1.8 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.5 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | UH | 7.1 | 3.6 | 1.8 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 11 | H | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 13 | H | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 19 | HM-03 | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 340 | HE | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 17 | H | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 23 | H | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 36 | HM-03 | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 6.4 | H | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 35 | H | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 27 | HM-03 | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | UH | 3.5 | 1.8 | 0.89 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 1500 | HEM-03 | 3.5 | 1.8 | 0.89 | ng/L | 3 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | | 141 | 50-150 | H | 122 | 50-150 | H | 146 | 50-150 |
| 13C2_6:2FTS | N | 179 | 50-150 | H | 119 | 50-150 | HN | 212 | 50-150 |
| 13C2_8:2FTS | | 109 | 50-150 | H | 115 | 50-150 | H | 115 | 50-150 |
| 13C2_PFDoA | | 97 | 50-150 | H | 107 | 50-150 | H | 89 | 50-150 |
| 13C2_PFTeDA | | 54 | 50-150 | H | 79 | 50-150 | H | 57 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 | H | 114 | 50-150 | H | 98 | 50-150 |
| 13C3_PFHxS | | 102 | 50-150 | H | 118 | 50-150 | H | 91 | 50-150 |
| 13C4_PFBA | | 54 | 50-150 | H | 68 | 50-150 | H | 88 | 50-150 |
| 13C4_PFHpA | | 95 | 50-150 | H | 118 | 50-150 | H | 94 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 | H | 119 | 50-150 | H | 101 | 50-150 |
| 13C5_PFPeA | | 90 | 50-150 | H | 119 | 50-150 | H | 92 | 50-150 |
| 13C6_PFDA | | 94 | 50-150 | H | 125 | 50-150 | H | 95 | 50-150 |
| 13C7_PFUdA | | 85 | 50-150 | H | 120 | 50-150 | H | 92 | 50-150 |
| 13C8_PFOA | | 102 | 50-150 | H | 119 | 50-150 | H | 95 | 50-150 |
| 13C8_PFOS | | 85 | 50-150 | H | 108 | 50-150 | H | 88 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-018
Description: VRTB-D-B1_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0915
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | | 94 | 50-150 | H | 112 | 50-150 | H | 103 | 50-150 |
| 13C9_PFNA | | 88 | 50-150 | H | 117 | 50-150 | H | 87 | 50-150 |
| d5-EtFOSAA | | 96 | 50-150 | H | 112 | 50-150 | H | 108 | 50-150 |
| d-MeFOSA | | 76 | 50-150 | H | 106 | 50-150 | H | 114 | 50-150 |
| d3-MeFOSAA | | 103 | 50-150 | H | 115 | 50-150 | H | 105 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-019
Description: VRTB-D-S2_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0950
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1816 | LAB | 09/15/2022 1253 | 54257 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/25/2022 1348 | ALM | 09/15/2022 1253 | 54257 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2022 1855 | BWS | 10/06/2022 1957 | 56292 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UQ | 14 | 7.0 | 3.5 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | UQ | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 17 | Q | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 5.0 | Q | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 28 | Q | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 130 | Q | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 7.1 | QM-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 5.5 | Q | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 14 | QM-03 | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | JQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 17 | Q | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 10 | Q | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | UQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 340 | EQ | 3.5 | 1.8 | 0.87 | ng/L | 1 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 40 | 50-150 | HN | 39 | 50-150 | HN | 165 | 50-150 |
| 13C2_6:2FTS | N | 46 | 50-150 | HN | 29 | 50-150 | HN | 218 | 50-150 |
| 13C2_8:2FTS | N | 41 | 50-150 | HM- | 38 | 50-150 | H | 111 | 50-150 |
| 13C2_PFDoA | N | 38 | 50-150 | HN | 37 | 50-150 | H | 78 | 50-150 |
| 13C2_PFTeDA | N | 19 | 50-150 | HN | 19 | 50-150 | HN | 33 | 50-150 |
| 13C3_PFBS | N | 37 | 50-150 | HN | 36 | 50-150 | H | 95 | 50-150 |
| 13C3_PFHxS | N | 42 | 50-150 | HN | 31 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | N | 39 | 50-150 | HN | 38 | 50-150 | H | 89 | 50-150 |
| 13C4_PFHpA | N | 38 | 50-150 | HN | 34 | 50-150 | H | 99 | 50-150 |
| 13C5_PFHxA | N | 43 | 50-150 | HN | 35 | 50-150 | H | 113 | 50-150 |
| 13C5_PFPeA | N | 36 | 50-150 | HN | 39 | 50-150 | H | 90 | 50-150 |
| 13C6_PFDA | N | 31 | 50-150 | HM- | 40 | 50-150 | H | 92 | 50-150 |
| 13C7_PFUdA | N | 39 | 50-150 | HN | 37 | 50-150 | H | 89 | 50-150 |
| 13C8_PFOA | N | 40 | 50-150 | HN | 34 | 50-150 | H | 91 | 50-150 |
| 13C8_PFOS | N | 33 | 50-150 | HN | 34 | 50-150 | H | 89 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-019
Description: VRTB-D-S2_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0950
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | N | 39 | 50-150 | HN | 36 | 50-150 | H | 92 | 50-150 |
| 13C9_PFNA | N | 39 | 50-150 | HN | 35 | 50-150 | H | 92 | 50-150 |
| d5-EtFOSAA | N | 43 | 50-150 | HN | 39 | 50-150 | H | 96 | 50-150 |
| d-MeFOSA | N | 24 | 50-150 | HN | 35 | 50-150 | H | 73 | 50-150 |
| d3-MeFOSAA | N | 40 | 50-150 | HN | 40 | 50-150 | H | 100 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-019
Description: VRTB-D-S2_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0950
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1816 | LAB | 09/15/2022 1253 | 54257 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/25/2022 1348 | ALM | 09/15/2022 1253 | 54257 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2022 1855 | BWS | 10/06/2022 1957 | 56292 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 18 | UHQ | 35 | 18 | 8.7 | ng/L | 2 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 18 | UHQ | 35 | 18 | 8.7 | ng/L | 2 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 18 | UHQ | 35 | 18 | 8.7 | ng/L | 2 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 18 | UHQ | 35 | 18 | 8.7 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 35 | UHQ | 69 | 35 | 17 | ng/L | 2 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 18 | UHQ | 35 | 18 | 8.7 | ng/L | 2 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 17 | HQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 8.5 | UHQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 6.9 | HJQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 8.5 | UHQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 8.5 | UHQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 32 | HQM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 170 | HQM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.1 | HJQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 8.5 | UHQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 8.5 | UHQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 5.7 | HJQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 13 | HJQM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 8.5 | UHQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 18 | HQM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 9.4 | HJQM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 8.5 | UHQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 8.5 | UHQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 8.5 | UHQ | 17 | 8.5 | 4.3 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 330 | HQM-03 | 17 | 8.5 | 4.3 | ng/L | 2 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 40 | 50-150 | HN | 39 | 50-150 | HN | 165 | 50-150 |
| 13C2_6:2FTS | N | 46 | 50-150 | HN | 29 | 50-150 | HN | 218 | 50-150 |
| 13C2_8:2FTS | N | 41 | 50-150 | HM- | 38 | 50-150 | H | 111 | 50-150 |
| 13C2_PFDoA | N | 38 | 50-150 | HN | 37 | 50-150 | H | 78 | 50-150 |
| 13C2_PFTeDA | N | 19 | 50-150 | HN | 19 | 50-150 | HN | 33 | 50-150 |
| 13C3_PFBS | N | 37 | 50-150 | HN | 36 | 50-150 | H | 95 | 50-150 |
| 13C3_PFHxS | N | 42 | 50-150 | HN | 31 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | N | 39 | 50-150 | HN | 38 | 50-150 | H | 89 | 50-150 |
| 13C4_PFHpA | N | 38 | 50-150 | HN | 34 | 50-150 | H | 99 | 50-150 |
| 13C5_PFHxA | N | 43 | 50-150 | HN | 35 | 50-150 | H | 113 | 50-150 |
| 13C5_PFPeA | N | 36 | 50-150 | HN | 39 | 50-150 | H | 90 | 50-150 |
| 13C6_PFDA | N | 31 | 50-150 | HM- | 40 | 50-150 | H | 92 | 50-150 |
| 13C7_PFUdA | N | 39 | 50-150 | HN | 37 | 50-150 | H | 89 | 50-150 |
| 13C8_PFOA | N | 40 | 50-150 | HN | 34 | 50-150 | H | 91 | 50-150 |
| 13C8_PFOS | N | 33 | 50-150 | HN | 34 | 50-150 | H | 89 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-019
Description: VRTB-D-S2_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0950
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | N | 39 | 50-150 | HN | 36 | 50-150 | H | 92 | 50-150 |
| 13C9_PFNA | N | 39 | 50-150 | HN | 35 | 50-150 | H | 92 | 50-150 |
| d5-EtFOSAA | N | 43 | 50-150 | HN | 39 | 50-150 | H | 96 | 50-150 |
| d-MeFOSA | N | 24 | 50-150 | HN | 35 | 50-150 | H | 73 | 50-150 |
| d3-MeFOSAA | N | 40 | 50-150 | HN | 40 | 50-150 | H | 100 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-019
Description: VRTB-D-S2_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0950
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1816 | LAB | 09/15/2022 1253 | 54257 |
| 2 | SOP SPE | PFAS by ID SOP QSM B-15 | 5 | 10/25/2022 1348 | ALM | 09/15/2022 1253 | 54257 |
| 3 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 10/11/2022 1855 | BWS | 10/06/2022 1957 | 56292 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | UH | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | UHQ | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | UHQ | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | UH | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | UH | 14 | 7.0 | 3.4 | ng/L | 3 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | UH | 6.9 | 3.5 | 1.7 | ng/L | 3 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 20 | H | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 5.2 | HM-03 | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 35 | HM-03 | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 150 | H | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 5.8 | H | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 5.7 | HM-03 | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 14 | HM-03 | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.5 | HJ | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 16 | HM-03 | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 10 | HM-03 | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UHQ | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | UH | 3.4 | 1.7 | 0.86 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 340 | HEM-03 | 3.4 | 1.7 | 0.86 | ng/L | 3 |

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 1 Acceptance Limits | Run 2 Q | Run 2 % Recovery | Run 2 Acceptance Limits | Run 3 Q | Run 3 % Recovery | Run 3 Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2_4:2FTS | N | 40 | 50-150 | HN | 39 | 50-150 | HN | 165 | 50-150 |
| 13C2_6:2FTS | N | 46 | 50-150 | HN | 29 | 50-150 | HN | 218 | 50-150 |
| 13C2_8:2FTS | N | 41 | 50-150 | HM- | 38 | 50-150 | H | 111 | 50-150 |
| 13C2_PFDoA | N | 38 | 50-150 | HN | 37 | 50-150 | H | 78 | 50-150 |
| 13C2_PFTeDA | N | 19 | 50-150 | HN | 19 | 50-150 | HN | 33 | 50-150 |
| 13C3_PFBS | N | 37 | 50-150 | HN | 36 | 50-150 | H | 95 | 50-150 |
| 13C3_PFHxS | N | 42 | 50-150 | HN | 31 | 50-150 | H | 99 | 50-150 |
| 13C4_PFBA | N | 39 | 50-150 | HN | 38 | 50-150 | H | 89 | 50-150 |
| 13C4_PFHpA | N | 38 | 50-150 | HN | 34 | 50-150 | H | 99 | 50-150 |
| 13C5_PFHxA | N | 43 | 50-150 | HN | 35 | 50-150 | H | 113 | 50-150 |
| 13C5_PFPeA | N | 36 | 50-150 | HN | 39 | 50-150 | H | 90 | 50-150 |
| 13C6_PFDA | N | 31 | 50-150 | HM- | 40 | 50-150 | H | 92 | 50-150 |
| 13C7_PFUdA | N | 39 | 50-150 | HN | 37 | 50-150 | H | 89 | 50-150 |
| 13C8_PFOA | N | 40 | 50-150 | HN | 34 | 50-150 | H | 91 | 50-150 |
| 13C8_PFOS | N | 33 | 50-150 | HN | 34 | 50-150 | H | 89 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-019
Description: VRTB-D-S2_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 0950
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C8_PFOSA | N | 39 | 50-150 | HN | 36 | 50-150 | H | 92 | 50-150 |
| 13C9_PFNA | N | 39 | 50-150 | HN | 35 | 50-150 | H | 92 | 50-150 |
| d5-EtFOSAA | N | 43 | 50-150 | HN | 39 | 50-150 | H | 96 | 50-150 |
| d-MeFOSA | N | 24 | 50-150 | HN | 35 | 50-150 | H | 73 | 50-150 |
| d3-MeFOSAA | N | 40 | 50-150 | HN | 40 | 50-150 | H | 100 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-020
Description: Dup-02_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1826 | LAB | 09/15/2022 1253 | 54257 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.6 | UQM-03 | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.6 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.6 | U | 7.1 | 3.6 | 1.8 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 18 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 5.9 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 32 | M-03 | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 160 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 6.7 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 5.5 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 14 | M-03 | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.5 | J | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 14 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 9.9 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.8 | UQ | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.8 | U | 3.6 | 1.8 | 0.89 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 300 | | 3.6 | 1.8 | 0.89 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 145 | 50-150 |
| 13C2_6:2FTS | N | 178 | 50-150 |
| 13C2_8:2FTS | | 96 | 50-150 |
| 13C2_PFDoA | | 87 | 50-150 |
| 13C2_PFTeDA | M-03N | 39 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 |
| 13C3_PFHxS | | 103 | 50-150 |
| 13C4_PFBA | | 85 | 50-150 |
| 13C4_PFHpA | | 101 | 50-150 |
| 13C5_PFHxA | | 125 | 50-150 |
| 13C5_PFPeA | | 97 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 89 | 50-150 |
| 13C8_PFOA | | 107 | 50-150 |
| 13C8_PFOS | | 92 | 50-150 |
| 13C8_PFOSA | | 85 | 50-150 |
| 13C9_PFNA | | 100 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-020
Description: Dup-02_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 94 | 50-150 |
| d-MeFOSA | | 68 | 50-150 |
| d3-MeFOSAA | | 92 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-021
Description: VRTB-D-Y3_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 1045
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1837 | LAB | 09/15/2022 1253 | 54257 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.4 | UQ | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.4 | U | 6.8 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 4.1 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.5 | JM-03 | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 7.4 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 63 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 3.7 | M-03 | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 2.6 | J | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 4.4 | M-03 | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | UM-03 | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 5.0 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 3.8 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | UQ | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.85 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 130 | | 3.4 | 1.7 | 0.85 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 121 | 50-150 |
| 13C2_6:2FTS | N | 213 | 50-150 |
| 13C2_8:2FTS | | 106 | 50-150 |
| 13C2_PFDoA | | 85 | 50-150 |
| 13C2_PFTeDA | N | 43 | 50-150 |
| 13C3_PFBS | | 93 | 50-150 |
| 13C3_PFHxS | | 97 | 50-150 |
| 13C4_PFBA | | 86 | 50-150 |
| 13C4_PFHpA | | 105 | 50-150 |
| 13C5_PFHxA | | 109 | 50-150 |
| 13C5_PFPeA | | 93 | 50-150 |
| 13C6_PFDA | | 79 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 98 | 50-150 |
| 13C8_PFOS | | 85 | 50-150 |
| 13C8_PFOSA | | 84 | 50-150 |
| 13C9_PFNA | | 94 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-021
Description: VRTB-D-Y3_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 1045
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 81 | 50-150 |
| d-MeFOSA | | 58 | 50-150 |
| d3-MeFOSAA | | 89 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-022
Description: VRTB-D-G4_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 1130
Date Received: 08/29/2022

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | SOP SPE | PFAS by ID SOP QSM B-15 | 1 | 09/28/2022 1848 | LAB | 09/15/2022 1253 | 54257 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 39108-34-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 27619-97-2 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| 1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS) | 757124-72-4 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA) | 2991-50-6 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamide (MeFOSA) | 31506-32-8 | PFAS by ID SOP | 7.0 | U | 14 | 7.0 | 3.4 | ng/L | 1 |
| N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA) | 2355-31-9 | PFAS by ID SOP | 3.5 | U | 6.9 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoro-1-butanesulfonic acid (PFBS) | 375-73-5 | PFAS by ID SOP | 0.95 | JM-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-decanesulfonic acid (PFDS) | 335-77-3 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-heptanesulfonic acid (PFHpS) | 375-92-8 | PFAS by ID SOP | 1.3 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-nonanesulfonic acid (PFNS) | 68259-12-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-octanesulfonamide (PFOSA) | 754-91-6 | PFAS by ID SOP | 1.7 | UM-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-1-pentanesulfonic acid (PFPeS) | 2706-91-4 | PFAS by ID SOP | 1.4 | J | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | PFAS by ID SOP | 39 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-butanoic acid (PFBA) | 375-22-4 | PFAS by ID SOP | 5.8 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-decanoic acid (PFDA) | 335-76-2 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-dodecanoic acid (PFDoA) | 307-55-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-heptanoic acid (PFHpA) | 375-85-9 | PFAS by ID SOP | 3.5 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-hexanoic acid (PFHxA) | 307-24-4 | PFAS by ID SOP | 12 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-nonanoic acid (PFNA) | 375-95-1 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | PFAS by ID SOP | 3.4 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-pentanoic acid (PFPeA) | 2706-90-3 | PFAS by ID SOP | 14 | M-03 | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tetradecanoic acid (PFTeDA) | 376-06-7 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-tridecanoic acid (PFTrDA) | 72629-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluoro-n-undecanoic acid (PFUdA) | 2058-94-8 | PFAS by ID SOP | 1.7 | U | 3.4 | 1.7 | 0.86 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | PFAS by ID SOP | 84 | | 3.4 | 1.7 | 0.86 | ng/L | 1 |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2_4:2FTS | | 108 | 50-150 |
| 13C2_6:2FTS | | 150 | 50-150 |
| 13C2_8:2FTS | | 98 | 50-150 |
| 13C2_PFDoA | | 105 | 50-150 |
| 13C2_PFTeDA | | 61 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 |
| 13C3_PFHxS | | 99 | 50-150 |
| 13C4_PFBA | | 83 | 50-150 |
| 13C4_PFHpA | | 89 | 50-150 |
| 13C5_PFHxA | | 92 | 50-150 |
| 13C5_PFPeA | | 96 | 50-150 |
| 13C6_PFDA | | 88 | 50-150 |
| 13C7_PFUdA | | 92 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 |
| 13C8_PFOS | | 91 | 50-150 |
| 13C8_PFOSA | | 97 | 50-150 |
| 13C9_PFNA | | 105 | 50-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: XH29054-022
Description: VRTB-D-G4_08242022
Matrix: Aqueous
Date Sampled: 08/24/2022 1130
Date Received: 08/29/2022

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| d5-EtFOSAA | | 96 | 50-150 |
| d-MeFOSA | | 60 | 50-150 |
| d3-MeFOSAA | | 93 | 50-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: XQ53996-001
Batch: 53996
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/13/2022 1209

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/20/2022 2009 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/20/2022 2009 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/20/2022 2009 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/20/2022 2009 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 09/20/2022 2009 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/20/2022 2009 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/20/2022 2009 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 113 | 50-150 |
| 13C2_6:2FTS | N | 203 | 50-150 |
| 13C2_8:2FTS | | 111 | 50-150 |
| 13C2_PFDoA | | 98 | 50-150 |
| 13C2_PFTeDA | | 100 | 50-150 |
| 13C3_PFBS | | 100 | 50-150 |
| 13C3_PFHxS | | 105 | 50-150 |
| 13C4_PFBA | | 106 | 50-150 |
| 13C4_PFHpA | | 107 | 50-150 |
| 13C5_PFHxA | | 104 | 50-150 |
| 13C5_PFPeA | | 107 | 50-150 |
| 13C6_PFDA | | 100 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 104 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ53996-001
Batch: 53996
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/13/2022 1209

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 102 | 50-150 |
| 13C8_PFOSA | | 111 | 50-150 |
| 13C9_PFNA | | 105 | 50-150 |
| d5-EtFOSAA | | 108 | 50-150 |
| d-MeFOSA | | 66 | 50-150 |
| d3-MeFOSAA | | 109 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ53996-002
Batch: 53996
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/13/2022 1209

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 13 | | 1 | 85 | 67-138 | 09/20/2022 2020 |
| 6:2 FTS | 15 | 14 | | 1 | 89 | 64-140 | 09/20/2022 2020 |
| 4:2 FTS | 15 | 14 | | 1 | 91 | 63-143 | 09/20/2022 2020 |
| EtFOSAA | 16 | 15 | M-03 | 1 | 95 | 61-135 | 09/20/2022 2020 |
| MeFOSA | 16 | 15 | | 1 | 95 | 68-141 | 09/20/2022 2020 |
| MeFOSAA | 16 | 14 | M-03 | 1 | 87 | 65-136 | 09/20/2022 2020 |
| PFBS | 14 | 13 | | 1 | 93 | 72-130 | 09/20/2022 2020 |
| PFDS | 15 | 14 | | 1 | 90 | 53-142 | 09/20/2022 2020 |
| PFHpS | 15 | 14 | | 1 | 94 | 69-134 | 09/20/2022 2020 |
| PFNS | 15 | 15 | | 1 | 96 | 69-127 | 09/20/2022 2020 |
| PFOSA | 16 | 15 | | 1 | 94 | 67-137 | 09/20/2022 2020 |
| PFPeS | 15 | 14 | | 1 | 93 | 71-127 | 09/20/2022 2020 |
| PFHxS | 15 | 14 | | 1 | 96 | 68-131 | 09/20/2022 2020 |
| PFBA | 16 | 15 | | 1 | 94 | 73-129 | 09/20/2022 2020 |
| PFDA | 16 | 15 | | 1 | 95 | 71-129 | 09/20/2022 2020 |
| PFDoA | 16 | 15 | | 1 | 95 | 72-134 | 09/20/2022 2020 |
| PFHpA | 16 | 16 | | 1 | 97 | 72-130 | 09/20/2022 2020 |
| PFHxA | 16 | 16 | | 1 | 99 | 72-129 | 09/20/2022 2020 |
| PFNA | 16 | 15 | | 1 | 94 | 69-130 | 09/20/2022 2020 |
| PFOA | 16 | 15 | | 1 | 96 | 71-133 | 09/20/2022 2020 |
| PFPeA | 16 | 16 | | 1 | 97 | 72-129 | 09/20/2022 2020 |
| PFTeDA | 16 | 15 | | 1 | 95 | 71-132 | 09/20/2022 2020 |
| PFTrDA | 16 | 15 | | 1 | 92 | 65-144 | 09/20/2022 2020 |
| PFUdA | 16 | 16 | | 1 | 97 | 69-133 | 09/20/2022 2020 |
| PFOS | 15 | 14 | M-03 | 1 | 96 | 65-140 | 09/20/2022 2020 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 117 | 50-150 |
| 13C2_6:2FTS | N | 214 | 50-150 |
| 13C2_8:2FTS | | 115 | 50-150 |
| 13C2_PFDoA | | 97 | 50-150 |
| 13C2_PFTeDA | | 98 | 50-150 |
| 13C3_PFBS | | 103 | 50-150 |
| 13C3_PFHxS | | 105 | 50-150 |
| 13C4_PFBA | | 106 | 50-150 |
| 13C4_PFHpA | | 105 | 50-150 |
| 13C5_PFHxA | | 101 | 50-150 |
| 13C5_PFPeA | | 105 | 50-150 |
| 13C6_PFDA | | 101 | 50-150 |
| 13C7_PFUdA | | 101 | 50-150 |
| 13C8_PFOA | | 105 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ53996-002
Batch: 53996
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/13/2022 1209

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 101 | 50-150 |
| 13C8_PFOSA | | 110 | 50-150 |
| 13C9_PFNA | | 106 | 50-150 |
| d5-EtFOSAA | | 105 | 50-150 |
| d-MeFOSA | | 70 | 50-150 |
| d3-MeFOSAA | | 116 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ54228-001
Batch: 54228
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1102

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1733 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1733 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1733 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1733 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 09/28/2022 1733 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1733 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1733 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 92 | 50-150 |
| 13C2_6:2FTS | | 106 | 50-150 |
| 13C2_8:2FTS | | 83 | 50-150 |
| 13C2_PFDoA | | 77 | 50-150 |
| 13C2_PFTeDA | | 72 | 50-150 |
| 13C3_PFBS | | 82 | 50-150 |
| 13C3_PFHxS | | 84 | 50-150 |
| 13C4_PFBA | | 87 | 50-150 |
| 13C4_PFHpA | | 83 | 50-150 |
| 13C5_PFHxA | | 88 | 50-150 |
| 13C5_PFPeA | | 89 | 50-150 |
| 13C6_PFDA | | 84 | 50-150 |
| 13C7_PFUdA | | 83 | 50-150 |
| 13C8_PFOA | | 84 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ54228-001
Batch: 54228
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1102

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 81 | 50-150 |
| 13C8_PFOSA | | 84 | 50-150 |
| 13C9_PFNA | | 85 | 50-150 |
| d5-EtFOSAA | | 86 | 50-150 |
| d-MeFOSA | | 68 | 50-150 |
| d3-MeFOSAA | | 83 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - LCS

Sample ID: XQ54228-002
Batch: 54228
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1102

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 17 | | 1 | 113 | 67-138 | 09/28/2022 1722 |
| 6:2 FTS | 15 | 20 | | 1 | 133 | 64-140 | 09/28/2022 1722 |
| 4:2 FTS | 15 | 15 | | 1 | 103 | 63-143 | 09/28/2022 1722 |
| EtFOSAA | 16 | 18 | M-03 | 1 | 111 | 61-135 | 09/28/2022 1722 |
| MeFOSA | 16 | 19 | M-03 | 1 | 116 | 68-141 | 09/28/2022 1722 |
| MeFOSAA | 16 | 16 | M-03 | 1 | 99 | 65-136 | 09/28/2022 1722 |
| PFBS | 14 | 14 | | 1 | 98 | 72-130 | 09/28/2022 1722 |
| PFDS | 15 | 14 | | 1 | 90 | 53-142 | 09/28/2022 1722 |
| PFHpS | 15 | 15 | M-03 | 1 | 99 | 69-134 | 09/28/2022 1722 |
| PFNS | 15 | 16 | | 1 | 101 | 69-127 | 09/28/2022 1722 |
| PFOSA | 16 | 17 | M-03 | 1 | 109 | 67-137 | 09/28/2022 1722 |
| PFPeS | 15 | 15 | | 1 | 102 | 71-127 | 09/28/2022 1722 |
| PFHxS | 15 | 14 | M-03 | 1 | 99 | 68-131 | 09/28/2022 1722 |
| PFBA | 16 | 16 | | 1 | 103 | 73-129 | 09/28/2022 1722 |
| PFDA | 16 | 17 | | 1 | 104 | 71-129 | 09/28/2022 1722 |
| PFDoA | 16 | 16 | | 1 | 99 | 72-134 | 09/28/2022 1722 |
| PFHpA | 16 | 16 | | 1 | 102 | 72-130 | 09/28/2022 1722 |
| PFHxA | 16 | 16 | | 1 | 99 | 72-129 | 09/28/2022 1722 |
| PFNA | 16 | 16 | | 1 | 98 | 69-130 | 09/28/2022 1722 |
| PFOA | 16 | 16 | | 1 | 102 | 71-133 | 09/28/2022 1722 |
| PFPeA | 16 | 17 | | 1 | 103 | 72-129 | 09/28/2022 1722 |
| PFTeDA | 16 | 16 | | 1 | 101 | 71-132 | 09/28/2022 1722 |
| PFTrDA | 16 | 15 | | 1 | 91 | 65-144 | 09/28/2022 1722 |
| PFUdA | 16 | 16 | M-03 | 1 | 101 | 69-133 | 09/28/2022 1722 |
| PFOS | 15 | 15 | M-03 | 1 | 100 | 65-140 | 09/28/2022 1722 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 124 | 50-150 |
| 13C2_8:2FTS | | 81 | 50-150 |
| 13C2_PFDoA | | 79 | 50-150 |
| 13C2_PFTeDA | | 71 | 50-150 |
| 13C3_PFBS | | 90 | 50-150 |
| 13C3_PFHxS | | 92 | 50-150 |
| 13C4_PFBA | | 89 | 50-150 |
| 13C4_PFHpA | | 88 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 92 | 50-150 |
| 13C6_PFDA | | 87 | 50-150 |
| 13C7_PFUdA | | 84 | 50-150 |
| 13C8_PFOA | | 88 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ54228-002
Batch: 54228
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1102

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 89 | 50-150 |
| 13C8_PFOSA | | 88 | 50-150 |
| 13C9_PFNA | | 89 | 50-150 |
| d5-EtFOSAA | | 84 | 50-150 |
| d-MeFOSA | | 74 | 50-150 |
| d3-MeFOSAA | | 85 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ54257-001
Batch: 54257
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1253

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1516 |
| 6:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1516 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1516 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1516 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 09/28/2022 1516 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 09/28/2022 1516 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |
| PFOS | 2.0 | UM-03 | 1 | 4.0 | 2.0 | 1.0 | ng/L | 09/28/2022 1516 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 109 | 50-150 |
| 13C2_8:2FTS | | 132 | 50-150 |
| 13C2_PFDoA | | 107 | 50-150 |
| 13C2_PFTeDA | | 94 | 50-150 |
| 13C3_PFBS | | 99 | 50-150 |
| 13C3_PFHxS | | 93 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 108 | 50-150 |
| 13C5_PFHxA | | 105 | 50-150 |
| 13C5_PFPeA | | 103 | 50-150 |
| 13C6_PFDA | | 88 | 50-150 |
| 13C7_PFUdA | | 102 | 50-150 |
| 13C8_PFOA | | 104 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ54257-001
Batch: 54257
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1253

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 100 | 50-150 |
| 13C9_PFNA | | 100 | 50-150 |
| d5-EtFOSAA | | 108 | 50-150 |
| d-MeFOSA | | 66 | 50-150 |
| d3-MeFOSAA | | 106 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ54257-002
Batch: 54257
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1253

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 17 | | 1 | 112 | 67-138 | 09/28/2022 1526 |
| 6:2 FTS | 15 | 16 | | 1 | 105 | 64-140 | 09/28/2022 1526 |
| 4:2 FTS | 15 | 17 | | 1 | 114 | 63-143 | 09/28/2022 1526 |
| EtFOSAA | 16 | 15 | | 1 | 96 | 61-135 | 09/28/2022 1526 |
| MeFOSA | 16 | 21 | | 1 | 130 | 68-141 | 09/28/2022 1526 |
| MeFOSAA | 16 | 18 | M-03 | 1 | 110 | 65-136 | 09/28/2022 1526 |
| PFBS | 14 | 14 | | 1 | 96 | 72-130 | 09/28/2022 1526 |
| PFDS | 15 | 14 | | 1 | 93 | 53-142 | 09/28/2022 1526 |
| PFHpS | 15 | 15 | | 1 | 100 | 69-134 | 09/28/2022 1526 |
| PFNS | 15 | 15 | | 1 | 98 | 69-127 | 09/28/2022 1526 |
| PFOSA | 16 | 16 | | 1 | 102 | 67-137 | 09/28/2022 1526 |
| PFPeS | 15 | 14 | | 1 | 95 | 71-127 | 09/28/2022 1526 |
| PFHxS | 15 | 14 | | 1 | 95 | 68-131 | 09/28/2022 1526 |
| PFBA | 16 | 16 | | 1 | 100 | 73-129 | 09/28/2022 1526 |
| PFDA | 16 | 16 | | 1 | 98 | 71-129 | 09/28/2022 1526 |
| PFDoA | 16 | 16 | | 1 | 101 | 72-134 | 09/28/2022 1526 |
| PFHpA | 16 | 16 | | 1 | 102 | 72-130 | 09/28/2022 1526 |
| PFHxA | 16 | 19 | | 1 | 119 | 72-129 | 09/28/2022 1526 |
| PFNA | 16 | 16 | | 1 | 102 | 69-130 | 09/28/2022 1526 |
| PFOA | 16 | 16 | | 1 | 99 | 71-133 | 09/28/2022 1526 |
| PFPeA | 16 | 16 | | 1 | 102 | 72-129 | 09/28/2022 1526 |
| PFTeDA | 16 | 17 | | 1 | 103 | 71-132 | 09/28/2022 1526 |
| PFTrDA | 16 | 14 | | 1 | 87 | 65-144 | 09/28/2022 1526 |
| PFUdA | 16 | 15 | | 1 | 95 | 69-133 | 09/28/2022 1526 |
| PFOS | 15 | 16 | | 1 | 106 | 65-140 | 09/28/2022 1526 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 96 | 50-150 |
| 13C2_6:2FTS | | 104 | 50-150 |
| 13C2_8:2FTS | | 102 | 50-150 |
| 13C2_PFDoA | | 101 | 50-150 |
| 13C2_PFTeDA | | 85 | 50-150 |
| 13C3_PFBS | | 95 | 50-150 |
| 13C3_PFHxS | | 98 | 50-150 |
| 13C4_PFBA | | 95 | 50-150 |
| 13C4_PFHpA | | 97 | 50-150 |
| 13C5_PFHxA | | 93 | 50-150 |
| 13C5_PFPeA | | 90 | 50-150 |
| 13C6_PFDA | | 81 | 50-150 |
| 13C7_PFUdA | | 94 | 50-150 |
| 13C8_PFOA | | 99 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ54257-002
Batch: 54257
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/15/2022 1253

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 90 | 50-150 |
| 13C8_PFOSA | | 96 | 50-150 |
| 13C9_PFNA | | 98 | 50-150 |
| d5-EtFOSAA | | 93 | 50-150 |
| d-MeFOSA | | 60 | 50-150 |
| d3-MeFOSAA | | 93 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ56292-001
Batch: 56292
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 10/06/2022 1957

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2022 1810 |
| 6:2 FTS | 4.0 | UM-03 | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2022 1810 |
| 4:2 FTS | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2022 1810 |
| EtFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2022 1810 |
| MeFOSA | 8.0 | U | 1 | 16 | 8.0 | 4.0 | ng/L | 10/11/2022 1810 |
| MeFOSAA | 4.0 | U | 1 | 8.0 | 4.0 | 2.0 | ng/L | 10/11/2022 1810 |
| PFBS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFDS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFHpS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFNS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFOSA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFPeS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFHxS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFBA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFDoA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFHpA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFHxA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFNA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFOA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFPeA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFTeDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFTrDA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFUdA | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |
| PFOS | 2.0 | U | 1 | 4.0 | 2.0 | 1.0 | ng/L | 10/11/2022 1810 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 107 | 50-150 |
| 13C2_6:2FTS | N | 333 | 50-150 |
| 13C2_8:2FTS | | 106 | 50-150 |
| 13C2_PFDoA | | 95 | 50-150 |
| 13C2_PFTeDA | | 82 | 50-150 |
| 13C3_PFBS | | 97 | 50-150 |
| 13C3_PFHxS | | 96 | 50-150 |
| 13C4_PFBA | | 98 | 50-150 |
| 13C4_PFHpA | | 99 | 50-150 |
| 13C5_PFHxA | | 97 | 50-150 |
| 13C5_PFPeA | | 98 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 |
| 13C7_PFUdA | | 94 | 50-150 |
| 13C8_PFOA | | 95 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: XQ56292-001
Batch: 56292
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 10/06/2022 1957

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 93 | 50-150 |
| 13C8_PFOSA | | 99 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d5-EtFOSAA | | 101 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 101 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ56292-002
Batch: 56292
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 10/06/2022 1957

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 8:2 FTS | 15 | 16 | M-03 | 1 | 105 | 67-138 | 10/11/2022 1821 |
| 6:2 FTS | 15 | 15 | | 1 | 101 | 64-140 | 10/11/2022 1821 |
| 4:2 FTS | 15 | 16 | | 1 | 109 | 63-143 | 10/11/2022 1821 |
| EtFOSAA | 16 | 16 | M-03 | 1 | 99 | 61-135 | 10/11/2022 1821 |
| MeFOSA | 16 | 16 | | 1 | 103 | 68-141 | 10/11/2022 1821 |
| MeFOSAA | 16 | 14 | M-03 | 1 | 90 | 65-136 | 10/11/2022 1821 |
| PFBS | 14 | 14 | | 1 | 102 | 72-130 | 10/11/2022 1821 |
| PFDS | 15 | 14 | | 1 | 89 | 53-142 | 10/11/2022 1821 |
| PFHpS | 15 | 16 | | 1 | 103 | 69-134 | 10/11/2022 1821 |
| PFNS | 15 | 14 | | 1 | 89 | 69-127 | 10/11/2022 1821 |
| PFOSA | 16 | 15 | | 1 | 91 | 67-137 | 10/11/2022 1821 |
| PFPeS | 15 | 14 | | 1 | 96 | 71-127 | 10/11/2022 1821 |
| PFHxS | 15 | 15 | | 1 | 103 | 68-131 | 10/11/2022 1821 |
| PFBA | 16 | 16 | | 1 | 100 | 73-129 | 10/11/2022 1821 |
| PFDA | 16 | 17 | | 1 | 104 | 71-129 | 10/11/2022 1821 |
| PFDoA | 16 | 16 | | 1 | 101 | 72-134 | 10/11/2022 1821 |
| PFHpA | 16 | 16 | | 1 | 100 | 72-130 | 10/11/2022 1821 |
| PFHxA | 16 | 17 | | 1 | 103 | 72-129 | 10/11/2022 1821 |
| PFNA | 16 | 16 | | 1 | 97 | 69-130 | 10/11/2022 1821 |
| PFOA | 16 | 15 | | 1 | 95 | 71-133 | 10/11/2022 1821 |
| PFPeA | 16 | 16 | | 1 | 100 | 72-129 | 10/11/2022 1821 |
| PFTeDA | 16 | 17 | | 1 | 103 | 71-132 | 10/11/2022 1821 |
| PFTrDA | 16 | 16 | | 1 | 97 | 65-144 | 10/11/2022 1821 |
| PFUdA | 16 | 17 | | 1 | 108 | 69-133 | 10/11/2022 1821 |
| PFOS | 15 | 15 | M-03 | 1 | 100 | 65-140 | 10/11/2022 1821 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2_4:2FTS | | 106 | 50-150 |
| 13C2_6:2FTS | N | 354 | 50-150 |
| 13C2_8:2FTS | | 108 | 50-150 |
| 13C2_PFDoA | | 96 | 50-150 |
| 13C2_PFTeDA | | 89 | 50-150 |
| 13C3_PFBS | | 98 | 50-150 |
| 13C3_PFHxS | | 94 | 50-150 |
| 13C4_PFBA | | 99 | 50-150 |
| 13C4_PFHpA | | 93 | 50-150 |
| 13C5_PFHxA | | 94 | 50-150 |
| 13C5_PFPeA | | 102 | 50-150 |
| 13C6_PFDA | | 96 | 50-150 |
| 13C7_PFUdA | | 93 | 50-150 |
| 13C8_PFOA | | 96 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: XQ56292-002
Batch: 56292
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 10/06/2022 1957

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C8_PFOS | | 97 | 50-150 |
| 13C8_PFOSA | | 101 | 50-150 |
| 13C9_PFNA | | 99 | 50-150 |
| d5-EtFOSAA | | 104 | 50-150 |
| d-MeFOSA | | 80 | 50-150 |
| d3-MeFOSAA | | 101 | 50-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# Chain of Custody
# and
# Miscellaneous Documents

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 135008

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: 281-554-5992 / khasbrouck@arcadis.com; 248-926-5367 / Craig.Divine@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x Austin Westhuis | Analysis (Attach list if more space is needed) | Page 1 of 2 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | XH29054 |
| Project Name: ESTCP Vertebrae - Grayling, MI | | | KES2 |
| Project No.: 30027244.00003 | P.O. No. | | Remarks / Cooler I.D. |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab (G) / Composite (C) | Matrix: Aqueous | Soil | Tissue/Biosolids | No of Containers by Preservative Type: Unpres. | H2SO4 | HNO3 | HCl | NaOH | ZnAc NaOH | Field Filtered | PFAS as WSEPA Method 537 w/ isotope dilution Rev. C (Mod) 15.2 | Top Assay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-D-MS_08222022 | 8/22/22 | 1350 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-06_08222022 | 8/22/22 | 1500 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-R7_08222022 | 8/22/22 | 1600 | G | X | | | 2 | | | | | | | X | |
| VRTB-D-PB_08222022 | 8/22/22 | 1705 | G | X | | | 2 | | | | | | | X | |
| Dup-01_08222022 | 8/22/22 | — | G | X | | | 2 | | | | | | | X | |
| VRTB-S-B1_08222022 | 8/22/22 | 1800 | G | X | | | 2 | | | | | | | X | |
| VRTB-S-S2_08222022 | 8/22/22 | 1835 | G | X | | | 2 | | | | | | | X | |
| VRTB-S-Y3_08232022 | 8/23/22 | 0920 | G | X | | | 2 | | | | | | | X | |
| VRTB-S-G4_08232022 | 8/23/22 | 1015 | G | X | | | 2 | | | | | | | X | |
| VRTB-L-B1_08232022 | 8/23/22 | 1240 | G | X | | | 2 | | | | | | | X | |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify)

**Sample Disposal:** ☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification:** ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | Date | Time |
|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | 8/25/22 | 1700 |
| 2. Relinquished by: | Date | Time |
| 3. Relinquished by: | Date | Time |
| 4. Relinquished by: fedex | Date 8-29-22 | Time 940 |

| | Date | Time |
|---|---|---|
| 1. Received by: FedEx | 8/25/22 | 1700 |
| 2. Received by: | Date | Time |
| 3. Received by: | Date | Time |
| 4. Laboratory received by: | Date 8-29-22 | Time 940 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice: (Circle) (Yes) No Ice Pack — Receipt Temp. 15.6 °C — Temp Blank: ☐ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy * Level II Package Required

Document Number: ME003N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 135009

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: 231-534-5092 / khasbrouck@arcadis-us.com, 720-308-5564 / Craig.Divine@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x [signature] | Analysis (Attach list if more space is needed) | Page 2 of 2 |
| City: Novi / State: MI / Zip Code: 48377 | Printed Name: Austin Westhuis | | |
| Project Name: ESTCP Vertebrae - Grayling, MI | | | XH29054 |
| Project No.: 30027244.00003 | P.O. No. | | KES2 |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab/Composite | Matrix: Aqueous | Soil | Wipe/Swab | No of Containers by Preservative Type: Unpres. | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | Field Filtered | Analysis: 537 w/ 15 Analytes (EPA 537.1 Rev. 2.0 2018) | Top Assay | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-L-S2_08232022 | 8/23/22 | 1325 | G | X | | | 2 | | | | | | | | X | |
| VRTB-L-Y3_08232022 | 8/23/22 | 1420 | G | X | | | 2 | | | | | | | | X | |
| VRTB-L-G4_08232022 | 8/23/22 | 1510 | G | X | | | 2 | | | | | | | | X | |
| VRTB-L-M5_08232022 | 8/23/22 | 1620 | G | X | | | 2 | | | | | | | | X | |
| VRTB-L-O6_08232022 | 8/23/22 | 1710 | G | X | | | 2 | | | | | | | | X | |
| VRTB-L-P7_08232022 | 8/23/22 | 1800 | G | X | | | 2 | | | | | | | | X | |
| VRTB-L-BB8_08232022 | 8/23/22 | 1840 | G | X | | | 2 | | | | | | | | X | |
| VRTB-D-B1_08242022 | 8/24/22 | 0915 | G | X | | | 2 | | | | | | | X | | |
| VRTB-D-S2_08242022 | 8/24/22 | 0950 | G | X | | | 2 | | | | | | | X | | |
| Dup-02_08242022 | 8/24/22 | —— | G | X | | | 2 | | | | | | | X | | |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify)

**Sample Disposal**: ☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification**: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | | Date | Time |
|---|---|---|---|
| 1. Relinquished by | Austin Westhuis / Arcadis | 8/25/22 | 1700 |
| 2. Relinquished by | | | |
| 3. Relinquished by | | | |
| 4. Relinquished by | fedex | 8.29.22 | 9:40 |

| | | Date | Time |
|---|---|---|---|
| 1. Received by | FedEx | 8/25/22 | 1700 |
| 2. Received by | | | |
| 3. Received by | | | |
| 4. Laboratory received by | [signature] | 8.29.22 | 9:40 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on Ice (Circle) (Yes) No Ice Pack — Receipt Temp. 15.0 °C — Temp Blank ☐ Y ☒ N

**DISTRIBUTION:** WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

* Level II Package Required

Document Number: ME003N2-01

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 135284

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Kristen Hasbrouck, Craig Divine | Telephone No. / E-mail: 231-533-5098 / khasbrouck@tetratech.com; 616-308-5367 / Craig.Divine@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x | Analysis (Attach list if more space is needed) | Page 3 of 3 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | XH29054 |
| Project Name: ESTCP Verkbrae - Grayling, MI | | | KES2 |
| Project No.: 30027244.00003 | P.O. No. | | Remarks / Cooler I.D. |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Sample Type (G=Grab, C=Composite) | Matrix: Analysis | Matrix: Solid | Matrix: Soil Analysis | No. of Containers by Preservative Type: Unpres | HNO3 | H2SO4 | NaOH | HCl | Methanol | Other | Analysis: PFAS by USEPA Method 537 w/ isotope dilution, Rev 1.1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-D-Y3_08242022 | 8/24/22 | 1045 | G | X | | | 2 | | | | | | | X |
| VRTB-D-64_08242022 | 8/24/22 | 1130 | G | X | | | 2 | | | | | | | X |

Turn Around Time Required (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client X Disposal by Lab

Possible Hazard Identification: X Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | 8/25/22 | 1700 | 1. Received by: FedEx | 8/25/22 | 1706 |
| 2. Relinquished by | Date | Time | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: Fedex | Date 8.29.22 | Time 940 | 4. Laboratory received by: [signature] | Date 8.29.22 | Time 940 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on Ice (Circle): (Yes) No Ice Pack; Receipt Temp.: 5.6 °C; Temp Blank: ☐ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01



PACE ANALYTICAL SERVICES, LLC

DC#_Title: ENV-FRM-WCOL-0286 v02_Samples Receipt Checklist (SRC)
Effective Date: 8/2/2022

# Sample Receipt Checklist (SRC)

Client: Arcadis  Cooler Inspected by/date: KDRW / 08/29/2022  Lot #: XH29054

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No | ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: NA

15.6 / 15.6 °C  NA / NA °C  NA / NA °C  NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles  IR Gun ID: 8  IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | ☐ NA | 3. Were all coolers received at or below 6.0°C? If no, was Project Manager notified? PM was Notified by: phone / (email) / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 7. Was collection date & time listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 8. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 9. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 10. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 11. Was adequate sample volume available? |
| ☐ Yes | ☑ No | | 12. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☑ Yes | ☐ No | | 13. Were all samples containers accounted for? (No missing/excess) |
| ☐ Yes | ☐ No | ☑ NA | 14. Were VOA, 8015C and RSK-175 samples free of bubbles >"pea-size" (¼" or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 15. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 16. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☑ No | ☐ NA | 18. Was the quote number listed on the container label? If yes, Quote # |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA. ☐
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Unique ID: NA.

Comments:

Qualtrax ID: 56360

# Performance Monitoring Event #5

# Report of Analysis

**Arcadis U.S., Inc.**
9954 Mayland Drive
Richmond, VA 23233
Attention: Jesse Wright

Project Name: Grayling GWS

Project Number: 30027244

Lot Number:**YJ28005**

Date Completed:01/15/2024

Kathy Smith

01/16/2024 2:11 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: YJ28005

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.
Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.4 has been followed for these samples, and specifically Table B-24 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples were compliant with DOD QSM 5.4 table B-24 and our PFAS SOP. Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). The CF is calculated as follows:

CF = DF * FV / Vo
FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a DoD/DOE accredited laboratory; however, the following analyses are currently not listed on our DoD/DOE scope of accreditation: Drinking Water: pH EPA 150.1, Turbidity EPA 180.1, Metals EPA 200.7 & 200.8, Mercury EPA 245.1, Anions EPA 300.0, Cyanide EPA 335.4, Nitrates EPA 353.2, Orthophosphate & Phosphorus EPA 365.1, EDB/DBCP EPA 504.1, HPC SIMPLATE, Color SM 2120 B-2011, Alkalinity SM 2320 B-2011, Specific Conductance SM 2510 B-2011, Residue-filterable (TDS) SM 2540 C, Calcium Hardness (CaCO2) SM 3500-Ca B-2011, TRC SM 4500 Cl G-2011, pH SM 4500 H=B-

2011, E.Coli, Total Coliform. Non-Potable Water: Metals EPA 200.7, Strontium EPA 200.8, Chlorate EPA 300.0, Cyanide EPA 335.4, Phenolics EPA 420.4, 2-Methyl-4,6-Dinitrophenol EPA 625.1, Propane RSK-175, Specific Conductance SM 2510 B-2011, Salinity SM2520 B, Residue- total SM 2540 B, Sulfite SM 4500 SO32- B-2011, Amenable Cyanide SM 4500-CN- G-2011, BOD & CBOD SM 5210 B, MBAS SM 5540 C-2011, Boron & Titanium SW-846 6010D, Boron, Molybdenum, & Titanium SW-846 6020B, Alcohols & Glycols SW-846 8015C, Pentachlorophenol SW-846 8151A, Ethyl Acetate, Hexane, & n-Hexane SW-846 8260D, SVOC 1,4-Dioxane, 4-Dimethyl aminoazobenzene, 1,4-Naphthoquinone, 3,5-Dinitroaniline, PETN SW-846 8270E, Amenable Cyanide SW-846 9012B. Solid and Chemical Materials: Boron & Titanium SW-846 6010D, Molybdenum SW-846 6020B, Ethylene Glycol SW-846 8015B, Pentachlorophenol SW-846 8151A, Chloroprene SW-846 8260B, SVOC 1,4-Dioxane, 1,3,5-Trinitrobenzene, 1,4- Naphthoquinone, 1,4-Phenylenediamine, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 3-Methylcholanthrene, 4-Aminobiphenyl, 4-Dimethyl aminoazobenzene, 4-Nitroquinoline-1-oxide, 7,12-Dimethylbenzo(a)anthracene, Chlorobenzilate, Diallate, Ethyl methanesulfonate, Isodrin, Isosafrole, Methyl methanesulfonate, n-Nitrosomethylethylamine, n-Nitrosomorpholine, n-Nitrosopiperidine, Piperonyl butoxide, Pronamide, Safrole, 3,5- Dinitroaniline, PETN SW-846 8270E, Oil & Grease SW-846 9071B.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18. If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

PFAS
For sample YJ28005-011 sample matrix prevented full volume from being extracted, precluding method mandated bottle rinse. Elution solvent was aliquoted directly into the reservoir, rinsing the inside. Surrogate recovery may be adversely affected.

The following samples required a dilution which was performed outside of the analytical holding time: YJ28005-001, YJ28005-002, YJ28005-005, YJ28005-006, YJ28005-007, YJ28005-008, YJ28005-024, YJ28005-026, YJ28005-029. All data has been reported.

Surrogate recovery for the following sample was outside the upper control limit: YJ28005-001, YJ28005-022, YJ28005-023. These samples did not contain any target analytes; therefore, the data has been reported.

Surrogate recovery for the following samples was outside control limits: YJ28005-011, YJ28005-015, YJ28005-020, YJ28005-021, YJ28005-024, YJ28005-025. Re-extraction and/or re-analysis was performed outside of holding time and all data has been reported.

The MS/MSD associated with samples YJ28005-001, YJ28005-004 had compounds recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-001 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-001 | 1 | N-ethyl | M-03 |
| 1633 | YJ28005-001 | 1 | N-methyl | M-03 |
| 1633 | YJ28005-001 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-001 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-001 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | YJ28005-001 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-001 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-001 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-001 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-001 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | YJ28005-001 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-001 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-001 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-001 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-001 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-001 | 2 | 13C6-PFDA | M-03 |
| 1633 | YJ28005-001 | 2 | 13C7-PFUnA | M-03 |
| 1633 | YJ28005-001 | 2 | 13C8-PFOS | M-03 |
| 1633 | YJ28005-001 | 2 | D3-NMeFOSA | M-03 |
| 1633 | YJ28005-001 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | YJ28005-001 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-001 | 3 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | YJ28005-001 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | YJ28005-001 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-001 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-001 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-001 | 3 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-001 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-001 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-002 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | YJ28005-002 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-002 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-002 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-002 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | YJ28005-002 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-002 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-002 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-002 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-002 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-002 | 2 | 13C8-PFOA | M-03 |
| 1633 | YJ28005-002 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | YJ28005-002 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-002 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-002 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-002 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-002 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | YJ28005-003 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-003 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-003 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-003 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-003 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-003 | 2 | 13C7-PFUnA | M-03 |
| 1633 | YJ28005-003 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | YJ28005-004 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-004 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-005 | 1 | 4,8-Dioxa-3H-perfluorononanoic acid | M-03 |
| 1633 | YJ28005-005 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-005 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-005 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-005 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-005 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-005 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | YJ28005-005 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | YJ28005-005 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-005 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-005 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-005 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-005 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-005 | 2 | 13C6-PFDA | M-03 |
| 1633 | YJ28005-005 | 2 | 13C7-PFUnA | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-005 | 2 | 13C8-PFOS | M-03 |
| 1633 | YJ28005-005 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | YJ28005-005 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-005 | 3 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | YJ28005-005 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | YJ28005-005 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-005 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | YJ28005-005 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-005 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-005 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-006 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | YJ28005-006 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | YJ28005-006 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-006 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-006 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-006 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-006 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-006 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | YJ28005-006 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-006 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-006 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-006 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-006 | 2 | 13C9-PFNA | M-03 |
| 1633 | YJ28005-006 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-006 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-006 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-006 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-006 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-006 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-006 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | YJ28005-007 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-007 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-007 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-007 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-007 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-007 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-007 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-007 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | YJ28005-007 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-007 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-007 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-007 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-007 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | YJ28005-007 | 2 | 13C3-HFPO-DA | M-03 |
| 1633 | YJ28005-007 | 2 | D5-NEtFOSA | M-03 |
| 1633 | YJ28005-007 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | YJ28005-007 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-007 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-007 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-007 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-007 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-007 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-007 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | YJ28005-008 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-008 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | YJ28005-008 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-008 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-008 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | YJ28005-008 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-008 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-008 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-008 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-008 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-008 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | YJ28005-008 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-008 | 2 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | YJ28005-008 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-008 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-008 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-008 | 2 | 13C3-PFBS | M-03 |
| 1633 | YJ28005-008 | 2 | 13C8-PFOS | M-03 |
| 1633 | YJ28005-008 | 2 | 13C9-PFNA | M-03 |
| 1633 | YJ28005-008 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | YJ28005-008 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-008 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-008 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-008 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-009 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | YJ28005-009 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-009 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-009 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-009 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-010 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | YJ28005-010 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-010 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | YJ28005-010 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-010 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-010 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-010 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-010 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | YJ28005-010 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-010 | 2 | 13C9-PFNA | M-03 |
| 1633 | YJ28005-010 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | YJ28005-011 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-011 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-011 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | YJ28005-011 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-011 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-011 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-011 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-011 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | YJ28005-011 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | YJ28005-011 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | YJ28005-011 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-011 | 2 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | YJ28005-011 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-011 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-011 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-011 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | YJ28005-011 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | YJ28005-011 | 2 | 13C2-4:2FTS | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-011 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | YJ28005-011 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-011 | 2 | 13C8-PFOA | M-03 |
| 1633 | YJ28005-011 | 2 | 13C9-PFNA | M-03 |
| 1633 | YJ28005-011 | 2 | D3-NMeFOSA | M-03 |
| 1633 | YJ28005-011 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | YJ28005-011 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-011 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-011 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-011 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-011 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | YJ28005-011 | 3 | 13C2-6:2FTS | M-03 |
| 1633 | YJ28005-011 | 3 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-011 | 3 | 13C2-PFDoA | M-03 |
| 1633 | YJ28005-011 | 3 | 13C6-PFDA | M-03 |
| 1633 | YJ28005-011 | 3 | 13C8-PFOA | M-03 |
| 1633 | YJ28005-011 | 3 | D5-NEtFOSAA | M-03 |
| 1633 | YJ28005-012 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-012 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-012 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-012 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-012 | 2 | 13C2-PFDoA | M-03 |
| 1633 | YJ28005-012 | 2 | D5-NEtFOSA | M-03 |
| 1633 | YJ28005-013 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-013 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-013 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-013 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-014 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-014 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-014 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-014 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-015 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-015 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-015 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-015 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-015 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-015 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-015 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-015 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-015 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-016 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-016 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-016 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-017 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-017 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-017 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-017 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-018 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-018 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-018 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-018 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-018 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-018 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-018 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-018 | 2 | 13C7-PFUnA | M-03 |
| 1633 | YJ28005-018 | 1 | D3-NMeFOSAA | M-03 |
| 1633 | YJ28005-018 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | YJ28005-019 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-019 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-019 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-019 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-020 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | YJ28005-020 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-020 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-020 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-020 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | YJ28005-020 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-020 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-020 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-020 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-020 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-020 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-021 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-021 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-021 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-021 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | YJ28005-021 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-021 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-021 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-021 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-021 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-022 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-022 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | YJ28005-022 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | YJ28005-022 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-022 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-022 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | YJ28005-022 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | YJ28005-022 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-022 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-022 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-022 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-022 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-023 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | YJ28005-023 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | YJ28005-023 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | YJ28005-023 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-023 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-023 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-023 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-023 | 2 | 13C2-PFDoA | M-03 |
| 1633 | YJ28005-023 | 2 | 13C6-PFDA | M-03 |
| 1633 | YJ28005-023 | 1 | 13C8-PFOS | M-03 |
| 1633 | YJ28005-023 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | YJ28005-023 | 2 | D9-NEtFOSE | M-03 |
| 1633 | YJ28005-024 | 1 | Perfluoro-4-methoxybutanoic acid | M-03 |
| 1633 | YJ28005-024 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | YJ28005-024 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-024 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | YJ28005-024 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-024 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-024 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-024 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-024 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | YJ28005-024 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-024 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-024 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-025 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | YJ28005-025 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-025 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-025 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | YJ28005-025 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-025 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-025 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | YJ28005-025 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-025 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-025 | 2 | N-ethyl | M-03 |
| 1633 | YJ28005-025 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | YJ28005-025 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-025 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-025 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-025 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-025 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | YJ28005-025 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | YJ28005-025 | 2 | 13C8-PFOSA | M-03 |
| 1633 | YJ28005-025 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | YJ28005-025 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-025 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-025 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-025 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-025 | 3 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-025 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-025 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-026 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | YJ28005-026 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-026 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | YJ28005-026 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-026 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-026 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-026 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | YJ28005-026 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | YJ28005-026 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-026 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-026 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-026 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-026 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-026 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-026 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | YJ28005-026 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-026 | 2 | 13C5-PFHxA | M-03 |
| 1633 | YJ28005-026 | 2 | 13C7-PFUnA | M-03 |
| 1633 | YJ28005-026 | 2 | 13C9-PFNA | M-03 |
| 1633 | YJ28005-026 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | YJ28005-026 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | YJ28005-027 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | YJ28005-027 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | YJ28005-027 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-027 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | YJ28005-027 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | YJ28005-027 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-027 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-027 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | YJ28005-028 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-028 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-028 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | YJ28005-029 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-029 | 1 | 2H,2H,3H,3H-Perfluorooctanoic acid | M-03 |
| 1633 | YJ28005-029 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-029 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-029 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | YJ28005-029 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-029 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YJ28005-029 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-029 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-029 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-029 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | YJ28005-029 | 1 | 13C2-6:2FTS | M-03 |
| 1633 | YJ28005-029 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-029 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-029 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-029 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | YJ28005-029 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | YJ28005-029 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-029 | 2 | 13C3-HFPO-DA | M-03 |
| 1633 | YJ28005-029 | 2 | 13C6-PFDA | M-03 |
| 1633 | YJ28005-029 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | YJ28005-029 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YJ28005-029 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | YJ28005-029 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-029 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-029 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-029 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-029 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | YJ28005-029 | 3 | 13C2-8:2FTS | M-03 |
| 1633 | YJ28005-029 | 3 | 13C2-PFTeDA | M-03 |
| 1633 | YJ28005-029 | 3 | 13C3-HFPO-DA | M-03 |
| 1633 | YJ28005-029 | 3 | 13C3-PFHxS | M-03 |
| 1633 | YJ28005-029 | 3 | 13C6-PFDA | M-03 |
| 1633 | YJ28005-029 | 3 | 13C8-PFOA | M-03 |
| 1633 | YJ28005-029 | 3 | 13C8-PFOS | M-03 |
| 1633 | YJ28005-030 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | YJ28005-030 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-030 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YJ28005-030 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-030 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-030 | 2 | 13C2-PFDoA | M-03 |
| 1633 | YJ28005-030 | 2 | 13C7-PFUnA | M-03 |
| 1633 | YQ90185-002 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YQ90185-002 | 1 | N-ethyl | M-03 |
| 1633 | YQ90185-102 | 1 | N-ethyl | M-03 |
| 1633 | YQ90185-002 | 1 | N-methyl | M-03 |
| 1633 | YQ90185-102 | 1 | N-methyl | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YJ28005-004MS | 1 | N-methyl | M-03 |
| 1633 | YQ90185-002 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | YQ90185-002 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | YQ90185-002 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | YQ90185-002 | 1 | 3-Perfluoroheptyl propanoic acid | M-03 |
| 1633 | YQ90185-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YQ90185-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-004MS | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YJ28005-004MD | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YQ90185-002 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | YQ90185-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YQ90185-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-004MS | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-004MD | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-004MS | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-004MD | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-004MD | 1 | D5-NEtFOSAA | M-03 |
| 1633 | YQ92532-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | YQ92532-102 | 1 | N-methyl | M-03 |
| 1633 | YJ28005-001MD | 3 | N-methyl | M-03 |
| 1633 | YQ92532-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | YQ92532-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | YQ92532-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YQ92532-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YQ92532-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YQ92532-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-001MS | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-001MD | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YJ28005-001MS | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YJ28005-001MD | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YQ90470-002 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | YQ90470-002 | 1 | N-ethyl | M-03 |
| 1633 | YQ90470-102 | 1 | N-ethyl | M-03 |
| 1633 | YQ90470-002 | 1 | N-methyl | M-03 |
| 1633 | YQ90470-102 | 1 | N-methyl | M-03 |
| 1633 | YQ90470-002 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | YQ90470-002 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YQ90470-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YQ90470-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YQ90470-002 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YQ90470-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YQ90470-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YQ90470-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YQ90470-002 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YQ90470-002 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | YQ90470-002 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | YQ90470-002 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | YQ90470-002 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | YQ92830-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | YQ92830-002 | 1 | N-ethyl | M-03 |
| 1633 | YQ92830-102 | 1 | N-ethyl | M-03 |
| 1633 | YQ92830-102 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | YQ92830-002 | 1 | N-methyl | M-03 |
| 1633 | YQ92830-102 | 1 | N-methyl | M-03 |
| 1633 | YQ92830-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | YQ92830-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YQ92830-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YQ92830-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YQ92830-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YQ92830-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YQ92830-102 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | YQ92830-102 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | YQ90523-002 | 1 | N-ethyl | M-03 |
| 1633 | YQ90523-102 | 1 | N-ethyl | M-03 |
| 1633 | YQ90523-002 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | YQ90523-102 | 1 | N-methyl | M-03 |
| 1633 | YQ90523-002 | 1 | Perfluoro-3-methoxypropanoic acid | M-03 |
| 1633 | YQ90523-002 | 1 | Perfluorobutanoic acid (PFBA) | M-08 |
| 1633 | YQ90523-002 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | YQ90523-002 | 1 | 3-Perfluoroheptyl propanoic acid | M-03 |
| 1633 | YQ90523-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YQ90523-002 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YQ90523-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YQ90523-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | YQ90523-002 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YQ90523-002 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | YQ90523-002 | 1 | 13C4-PFBA | M-08 |
| 1633 | YQ92740-102 | 1 | 1H,1H,2H,2H-Perfluorohexane sulfonic | M-03 |
| 1633 | YQ92740-102 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | YQ92740-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | YQ92740-002 | 1 | N-ethyl | M-03 |
| 1633 | YQ92740-102 | 1 | N-ethyl | M-03 |
| 1633 | YQ92740-102 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | YQ92740-002 | 1 | N-methyl | M-03 |
| 1633 | YQ92740-102 | 1 | N-methyl | M-03 |
| 1633 | YQ92740-102 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | YQ92740-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | YQ92740-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | YQ92740-102 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | YQ92740-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YQ92740-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YQ92740-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | YQ92740-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | YQ92740-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YQ92740-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YQ92740-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YQ92740-102 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | YQ90629-002 | 1 | N-ethyl | M-03 |
| 1633 | YQ90629-002 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | YQ90629-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | YQ90629-001 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | YQ90629-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | YQ90629-002 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | YQ90629-002 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | YQ90629-001 | 1 | 13C4-PFBA | M-03 |

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | 10/23/2023 1203 | 10/28/2023 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | 10/23/2023 1330 | 10/28/2023 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | 10/23/2023 1435 | 10/28/2023 |
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | 10/23/2023 1545 | 10/28/2023 |
| 005 | VRTB-L-M5_10232023 | Aqueous | 10/23/2023 1725 | 10/28/2023 |
| 006 | VRTB-L-06_10242023 | Aqueous | 10/24/2023 0923 | 10/28/2023 |
| 007 | VRTB-L-P7_10242023 | Aqueous | 10/24/2023 1252 | 10/28/2023 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | 10/24/2023 1343 | 10/28/2023 |
| 009 | VRTB-S-B1_10242023 | Aqueous | 10/24/2023 1516 | 10/28/2023 |
| 010 | VRTB-S-S2_10242023 | Aqueous | 10/24/2023 1706 | 10/28/2023 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | 10/24/2023 1800 | 10/28/2023 |
| 012 | VRTB-S-G4_10252023 | Aqueous | 10/25/2023 1025 | 10/28/2023 |
| 013 | VRTB-D-M5_10252023 | Aqueous | 10/25/2023 1154 | 10/28/2023 |
| 014 | VRTB-D-06_10252023 | Aqueous | 10/25/2023 1332 | 10/28/2023 |
| 015 | VRTB-D-R7_10252023 | Aqueous | 10/25/2023 1422 | 10/28/2023 |
| 016 | VRTB-D-P8_10252023 | Aqueous | 10/25/2023 1539 | 10/28/2023 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | 10/25/2023 1726 | 10/28/2023 |
| 018 | VRTB-D-B1_10262023 | Aqueous | 10/26/2023 0920 | 10/28/2023 |
| 019 | VRTB-D-S2_10262023 | Aqueous | 10/26/2023 1006 | 10/28/2023 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | 10/26/2023 1100 | 10/28/2023 |
| 021 | VRTB-D-G4_10262023 | Aqueous | 10/26/2023 1148 | 10/28/2023 |
| 022 | VRTB-S-06_10262023 | Aqueous | 10/26/2023 1303 | 10/28/2023 |
| 023 | VRTB-S-M5_10262023 | Aqueous | 10/26/2023 1431 | 10/28/2023 |
| 024 | VRTB-S-R7_10262023 | Aqueous | 10/26/2023 1549 | 10/28/2023 |
| 025 | VRTB-L-S2_10262023 | Aqueous | 10/26/2023 1703 | 10/28/2023 |
| 026 | VRTB-L-G4_10262023 | Aqueous | 10/26/2023 1749 | 10/28/2023 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | 10/26/2023 1840 | 10/28/2023 |
| 028 | VRTB-L-B1_10262023 | Aqueous | 10/26/2023 1925 | 10/28/2023 |
| 029 | DUP-01_10242023 | Aqueous | 10/24/2023 | 10/28/2023 |
| 030 | DUP-02_10252023 | Aqueous | 10/25/2023 | 10/28/2023 |

(30 samples)

## Detection Summary

## Arcadis U.S., Inc.

Lot Number: YJ28005

Project Name: Grayling GWS

Project Number: 30027244

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | 8:2FTS | 1633 | 37 | M-03 | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | 6:2FTS | 1633 | 140 | | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFBS | 1633 | 54 | | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFBA | 1633 | 120 | | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFDA | 1633 | 0.38 | J | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFHpS | 1633 | 430 | M-03 | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFHpA | 1633 | 240 | | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFHxA | 1633 | 480 | | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFNS | 1633 | 1.2 | M-03 | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFNA | 1633 | 85 | M-03 | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFOA | 1633 | 330 | M-03 | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFPeS | 1633 | 180 | | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFPeA | 1633 | 270 | | ng/L | 31 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFHxS | 1633 | 3800 | M-03 | ng/L | 33 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFOSA | 1633 | 3.0 | JM-03 | ng/L | 33 |
| 001 | CMT-VRTB-01_2_10232023 | Aqueous | PFOS | 1633 | 26000 | HSM-03 | ng/L | 35 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | 8:2FTS | 1633 | 24 | | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | 6:2FTS | 1633 | 37 | | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFBS | 1633 | 14 | | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFBA | 1633 | 49 | | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFHpS | 1633 | 73 | | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFHpA | 1633 | 88 | | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFHxA | 1633 | 150 | | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFNS | 1633 | 0.15 | JM-03 | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFNA | 1633 | 37 | M-03 | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFOSA | 1633 | 0.72 | JM-03 | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFOA | 1633 | 110 | M-03 | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFPeS | 1633 | 29 | | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFPeA | 1633 | 110 | | ng/L | 37 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFHxS | 1633 | 870 | M-03 | ng/L | 39 |
| 002 | CMT-VRTB-01_3_10232023 | Aqueous | PFOS | 1633 | 7500 | HM-03 | ng/L | 41 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | 6:2FTS | 1633 | 13 | | ng/L | 43 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | PFBS | 1633 | 11 | | ng/L | 43 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | PFBA | 1633 | 17 | | ng/L | 43 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | PFHpS | 1633 | 22 | M-03 | ng/L | 43 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | PFHpA | 1633 | 28 | | ng/L | 43 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | PFHxS | 1633 | 340 | M-03 | ng/L | 43 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | PFHxA | 1633 | 34 | | ng/L | 43 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | PFNA | 1633 | 9.9 | M-03 | ng/L | 43 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | PFOS | 1633 | 1200 | M-03 | ng/L | 43 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | PFOA | 1633 | 41 | M-03 | ng/L | 43 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | PFPeS | 1633 | 17 | | ng/L | 43 |
| 003 | CMT-VRTB-01_4_10232023 | Aqueous | PFPeA | 1633 | 27 | | ng/L | 43 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | PFBS | 1633 | 8.2 | | ng/L | 45 |
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | PFBA | 1633 | 10 | | ng/L | 45 |
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | PFHpS | 1633 | 8.1 | | ng/L | 45 |
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | PFHpA | 1633 | 10 | | ng/L | 45 |
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | PFHxS | 1633 | 130 | | ng/L | 45 |
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | PFHxA | 1633 | 15 | | ng/L | 45 |
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | PFNA | 1633 | 1.7 | | ng/L | 45 |
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | PFOS | 1633 | 280 | SM-03 | ng/L | 45 |
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | PFOA | 1633 | 16 | M-03 | ng/L | 45 |
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | PFPeS | 1633 | 11 | | ng/L | 45 |
| 004 | CMT-VRTB-01_5_10232023 | Aqueous | PFPeA | 1633 | 12 | | ng/L | 45 |
| 005 | VRTB-L-M5_10232023 | Aqueous | 8:2FTS | 1633 | 73 | | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | 6:2FTS | 1633 | 120 | | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFBS | 1633 | 18 | | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFBA | 1633 | 90 | | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFHpS | 1633 | 150 | | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFHpA | 1633 | 240 | | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFHxA | 1633 | 270 | | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFNA | 1633 | 63 | M-03 | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFOSA | 1633 | 1.3 | M-03 | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFOA | 1633 | 240 | M-03 | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFPeS | 1633 | 60 | | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFPeA | 1633 | 210 | | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | 3:3FTCA | 1633 | 0.86 | JM-03 | ng/L | 47 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFHxS | 1633 | 1700 | M-03 | ng/L | 49 |
| 005 | VRTB-L-M5_10232023 | Aqueous | PFOS | 1633 | 12000 | HM-03 | ng/L | 51 |
| 006 | VRTB-L-06_10242023 | Aqueous | 8:2FTS | 1633 | 70 | | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | 6:2FTS | 1633 | 140 | | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFBS | 1633 | 15 | | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFBA | 1633 | 80 | M-03 | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFDA | 1633 | 0.70 | JM-03 | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFHpS | 1633 | 180 | | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFHpA | 1633 | 180 | | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFHxA | 1633 | 220 | | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFNA | 1633 | 86 | M-03 | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFOSA | 1633 | 1.3 | M-03 | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFOA | 1633 | 220 | M-03 | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFPeS | 1633 | 70 | M-03 | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFPeA | 1633 | 150 | | ng/L | 53 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFHxS | 1633 | 1700 | M-03 | ng/L | 55 |
| 006 | VRTB-L-06_10242023 | Aqueous | PFOS | 1633 | 17000 | HM-03 | ng/L | 57 |
| 007 | VRTB-L-P7_10242023 | Aqueous | 8:2FTS | 1633 | 44 | M-03 | ng/L | 59 |
| 007 | VRTB-L-P7_10242023 | Aqueous | 6:2FTS | 1633 | 82 | | ng/L | 59 |
| 007 | VRTB-L-P7_10242023 | Aqueous | PFBS | 1633 | 13 | | ng/L | 59 |
| 007 | VRTB-L-P7_10242023 | Aqueous | PFBA | 1633 | 53 | | ng/L | 59 |
| 007 | VRTB-L-P7_10242023 | Aqueous | PFHpS | 1633 | 150 | | ng/L | 59 |
| 007 | VRTB-L-P7_10242023 | Aqueous | PFHpA | 1633 | 120 | | ng/L | 59 |
| 007 | VRTB-L-P7_10242023 | Aqueous | PFHxA | 1633 | 140 | | ng/L | 59 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 007 | VRTB-L-P7_10242023 | Aqueous | PFNA | 1633 | 67 | M-03 | ng/L | 59 |
| 007 | VRTB-L-P7_10242023 | Aqueous | PFOA | 1633 | 180 | M-03 | ng/L | 59 |
| 007 | VRTB-L-P7_10242023 | Aqueous | PFPeS | 1633 | 35 | | ng/L | 59 |
| 007 | VRTB-L-P7_10242023 | Aqueous | PFPeA | 1633 | 110 | | ng/L | 59 |
| 007 | VRTB-L-P7_10242023 | Aqueous | 3:3FTCA | 1633 | 2.0 | J | ng/L | 59 |
| 007 | VRTB-L-P7_10242023 | Aqueous | PFHxS | 1633 | 1200 | M-03 | ng/L | 61 |
| 007 | VRTB-L-P7_10242023 | Aqueous | PFOSA | 1633 | 2.3 | JM-03 | ng/L | 61 |
| 007 | VRTB-L-P7_10242023 | Aqueous | PFOS | 1633 | 17000 | HM-03 | ng/L | 63 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | 8:2FTS | 1633 | 25 | M-03 | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | 6:2FTS | 1633 | 43 | | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFMPA | 1633 | 2.8 | | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFBS | 1633 | 31 | | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFBA | 1633 | 52 | | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFDA | 1633 | 0.40 | JM-03 | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFHpS | 1633 | 170 | M-03 | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFHpA | 1633 | 94 | | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFHxA | 1633 | 210 | | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFNS | 1633 | 0.44 | JM-03 | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFNA | 1633 | 55 | M-03 | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFOSA | 1633 | 1.5 | M-03 | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFOA | 1633 | 150 | M-03 | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFPeS | 1633 | 89 | | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFPeA | 1633 | 99 | | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | 3:3FTCA | 1633 | 0.91 | J | ng/L | 65 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFHxS | 1633 | 1500 | M-03 | ng/L | 67 |
| 008 | VRTB-L-BB8_10242023 | Aqueous | PFOS | 1633 | 13000 | HM-03 | ng/L | 69 |
| 009 | VRTB-S-B1_10242023 | Aqueous | PFBS | 1633 | 3.0 | | ng/L | 71 |
| 009 | VRTB-S-B1_10242023 | Aqueous | PFBA | 1633 | 5.5 | M-03 | ng/L | 71 |
| 009 | VRTB-S-B1_10242023 | Aqueous | PFHpS | 1633 | 1.2 | | ng/L | 71 |
| 009 | VRTB-S-B1_10242023 | Aqueous | PFHpA | 1633 | 2.8 | | ng/L | 71 |
| 009 | VRTB-S-B1_10242023 | Aqueous | PFHxS | 1633 | 30 | M-03 | ng/L | 71 |
| 009 | VRTB-S-B1_10242023 | Aqueous | PFHxA | 1633 | 7.9 | | ng/L | 71 |
| 009 | VRTB-S-B1_10242023 | Aqueous | PFNA | 1633 | 0.37 | JM-03 | ng/L | 71 |
| 009 | VRTB-S-B1_10242023 | Aqueous | PFOS | 1633 | 180 | M-03 | ng/L | 71 |
| 009 | VRTB-S-B1_10242023 | Aqueous | PFOA | 1633 | 2.5 | M-03 | ng/L | 71 |
| 009 | VRTB-S-B1_10242023 | Aqueous | PFPeS | 1633 | 1.8 | | ng/L | 71 |
| 009 | VRTB-S-B1_10242023 | Aqueous | PFPeA | 1633 | 8.0 | | ng/L | 71 |
| 010 | VRTB-S-S2_10242023 | Aqueous | 8:2FTS | 1633 | 0.61 | J | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | 6:2FTS | 1633 | 2.4 | JM-03 | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFBS | 1633 | 4.7 | | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFBA | 1633 | 16 | | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFHpS | 1633 | 11 | | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFHpA | 1633 | 29 | | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFHxS | 1633 | 150 | M-03 | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFHxA | 1633 | 27 | | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFNS | 1633 | 0.44 | JM-03 | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFNA | 1633 | 21 | M-03 | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFOSA | 1633 | 1.1 | M-03 | ng/L | 73 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 010 | VRTB-S-S2_10242023 | Aqueous | PFOS | 1633 | 770 | M-03 | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFOA | 1633 | 46 | M-03 | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFPeS | 1633 | 7.4 | | ng/L | 73 |
| 010 | VRTB-S-S2_10242023 | Aqueous | PFPeA | 1633 | 25 | | ng/L | 73 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | 8:2FTS | 1633 | 2.7 | JM-03 | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFBS | 1633 | 7.6 | | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFBA | 1633 | 13 | | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFHpS | 1633 | 36 | | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFHpA | 1633 | 14 | | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFHxS | 1633 | 570 | M-03 | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFHxA | 1633 | 32 | | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFNS | 1633 | 0.42 | JM-03 | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFNA | 1633 | 5.9 | M-03 | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFOSA | 1633 | 2.2 | M-03 | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFOA | 1633 | 25 | M-03 | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFPeS | 1633 | 17 | | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFPeA | 1633 | 21 | | ng/L | 75 |
| 011 | VRTB-S-Y3_10242023 | Aqueous | PFOS | 1633 | 1600 | M-03 | ng/L | 77 |
| 012 | VRTB-S-G4_10252023 | Aqueous | PFBS | 1633 | 8.3 | | ng/L | 81 |
| 012 | VRTB-S-G4_10252023 | Aqueous | PFBA | 1633 | 8.9 | | ng/L | 81 |
| 012 | VRTB-S-G4_10252023 | Aqueous | PFHpS | 1633 | 23 | | ng/L | 81 |
| 012 | VRTB-S-G4_10252023 | Aqueous | PFHpA | 1633 | 8.3 | | ng/L | 81 |
| 012 | VRTB-S-G4_10252023 | Aqueous | PFHxS | 1633 | 470 | M-03 | ng/L | 81 |
| 012 | VRTB-S-G4_10252023 | Aqueous | PFHxA | 1633 | 17 | | ng/L | 81 |
| 012 | VRTB-S-G4_10252023 | Aqueous | PFNA | 1633 | 2.6 | M-03 | ng/L | 81 |
| 012 | VRTB-S-G4_10252023 | Aqueous | PFOS | 1633 | 1100 | M-03 | ng/L | 81 |
| 012 | VRTB-S-G4_10252023 | Aqueous | PFOA | 1633 | 14 | M-03 | ng/L | 81 |
| 012 | VRTB-S-G4_10252023 | Aqueous | PFPeS | 1633 | 21 | | ng/L | 81 |
| 012 | VRTB-S-G4_10252023 | Aqueous | PFPeA | 1633 | 9.2 | | ng/L | 81 |
| 013 | VRTB-D-M5_10252023 | Aqueous | PFBS | 1633 | 3.3 | | ng/L | 83 |
| 013 | VRTB-D-M5_10252023 | Aqueous | PFBA | 1633 | 6.1 | | ng/L | 83 |
| 013 | VRTB-D-M5_10252023 | Aqueous | PFHpS | 1633 | 3.8 | | ng/L | 83 |
| 013 | VRTB-D-M5_10252023 | Aqueous | PFHpA | 1633 | 6.2 | | ng/L | 83 |
| 013 | VRTB-D-M5_10252023 | Aqueous | PFHxS | 1633 | 65 | M-03 | ng/L | 83 |
| 013 | VRTB-D-M5_10252023 | Aqueous | PFHxA | 1633 | 9.0 | | ng/L | 83 |
| 013 | VRTB-D-M5_10252023 | Aqueous | PFNA | 1633 | 0.77 | JM-03 | ng/L | 83 |
| 013 | VRTB-D-M5_10252023 | Aqueous | PFOS | 1633 | 260 | M-03 | ng/L | 83 |
| 013 | VRTB-D-M5_10252023 | Aqueous | PFOA | 1633 | 6.8 | M-03 | ng/L | 83 |
| 013 | VRTB-D-M5_10252023 | Aqueous | PFPeS | 1633 | 3.4 | | ng/L | 83 |
| 013 | VRTB-D-M5_10252023 | Aqueous | PFPeA | 1633 | 8.8 | | ng/L | 83 |
| 014 | VRTB-D-06_10252023 | Aqueous | PFBS | 1633 | 2.3 | | ng/L | 85 |
| 014 | VRTB-D-06_10252023 | Aqueous | PFBA | 1633 | 4.1 | J | ng/L | 85 |
| 014 | VRTB-D-06_10252023 | Aqueous | PFHpS | 1633 | 7.5 | | ng/L | 85 |
| 014 | VRTB-D-06_10252023 | Aqueous | PFHpA | 1633 | 5.5 | | ng/L | 85 |
| 014 | VRTB-D-06_10252023 | Aqueous | PFHxS | 1633 | 72 | M-03 | ng/L | 85 |
| 014 | VRTB-D-06_10252023 | Aqueous | PFHxA | 1633 | 9.1 | | ng/L | 85 |
| 014 | VRTB-D-06_10252023 | Aqueous | PFNA | 1633 | 1.3 | M-03 | ng/L | 85 |
| 014 | VRTB-D-06_10252023 | Aqueous | PFOS | 1633 | 270 | M-03 | ng/L | 85 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 014 | VRTB-D-06_10252023 | Aqueous | PFOA | 1633 | 7.7 | M-03 | ng/L | 85 |
| 014 | VRTB-D-06_10252023 | Aqueous | PFPeS | 1633 | 4.1 | | ng/L | 85 |
| 014 | VRTB-D-06_10252023 | Aqueous | PFPeA | 1633 | 5.7 | | ng/L | 85 |
| 015 | VRTB-D-R7_10252023 | Aqueous | PFBS | 1633 | 5.8 | | ng/L | 87 |
| 015 | VRTB-D-R7_10252023 | Aqueous | PFBA | 1633 | 10 | | ng/L | 87 |
| 015 | VRTB-D-R7_10252023 | Aqueous | PFHpS | 1633 | 1.9 | M-03 | ng/L | 87 |
| 015 | VRTB-D-R7_10252023 | Aqueous | PFHpA | 1633 | 15 | | ng/L | 87 |
| 015 | VRTB-D-R7_10252023 | Aqueous | PFHxS | 1633 | 56 | M-03 | ng/L | 87 |
| 015 | VRTB-D-R7_10252023 | Aqueous | PFHxA | 1633 | 13 | | ng/L | 87 |
| 015 | VRTB-D-R7_10252023 | Aqueous | PFNA | 1633 | 1.0 | M-03 | ng/L | 87 |
| 015 | VRTB-D-R7_10252023 | Aqueous | PFOS | 1633 | 92 | M-03 | ng/L | 87 |
| 015 | VRTB-D-R7_10252023 | Aqueous | PFOA | 1633 | 11 | M-03 | ng/L | 87 |
| 015 | VRTB-D-R7_10252023 | Aqueous | PFPeS | 1633 | 2.0 | | ng/L | 87 |
| 015 | VRTB-D-R7_10252023 | Aqueous | PFPeA | 1633 | 16 | | ng/L | 87 |
| 016 | VRTB-D-P8_10252023 | Aqueous | PFBS | 1633 | 9.5 | | ng/L | 91 |
| 016 | VRTB-D-P8_10252023 | Aqueous | PFBA | 1633 | 15 | | ng/L | 91 |
| 016 | VRTB-D-P8_10252023 | Aqueous | PFHpS | 1633 | 2.9 | | ng/L | 91 |
| 016 | VRTB-D-P8_10252023 | Aqueous | PFHpA | 1633 | 25 | | ng/L | 91 |
| 016 | VRTB-D-P8_10252023 | Aqueous | PFHxS | 1633 | 86 | M-03 | ng/L | 91 |
| 016 | VRTB-D-P8_10252023 | Aqueous | PFHxA | 1633 | 26 | | ng/L | 91 |
| 016 | VRTB-D-P8_10252023 | Aqueous | PFNA | 1633 | 5.8 | | ng/L | 91 |
| 016 | VRTB-D-P8_10252023 | Aqueous | PFOS | 1633 | 210 | M-03 | ng/L | 91 |
| 016 | VRTB-D-P8_10252023 | Aqueous | PFOA | 1633 | 19 | M-03 | ng/L | 91 |
| 016 | VRTB-D-P8_10252023 | Aqueous | PFPeS | 1633 | 3.6 | | ng/L | 91 |
| 016 | VRTB-D-P8_10252023 | Aqueous | PFPeA | 1633 | 27 | | ng/L | 91 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | PFBS | 1633 | 9.1 | | ng/L | 93 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | PFBA | 1633 | 9.2 | | ng/L | 93 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | PFHpS | 1633 | 9.5 | | ng/L | 93 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | PFHpA | 1633 | 9.1 | | ng/L | 93 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | PFHxS | 1633 | 190 | M-03 | ng/L | 93 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | PFHxA | 1633 | 15 | | ng/L | 93 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | PFNA | 1633 | 1.2 | M-03 | ng/L | 93 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | PFOS | 1633 | 370 | M-03 | ng/L | 93 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | PFOA | 1633 | 19 | M-03 | ng/L | 93 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | PFPeS | 1633 | 13 | | ng/L | 93 |
| 017 | CMT-VRTB-01_6_10252023 | Aqueous | PFPeA | 1633 | 12 | | ng/L | 93 |
| 018 | VRTB-D-B1_10262023 | Aqueous | 8:2FTS | 1633 | 3.1 | JM-03 | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | 6:2FTS | 1633 | 14 | | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | PFBS | 1633 | 11 | | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | PFBA | 1633 | 21 | | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | PFHpS | 1633 | 29 | | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | PFHpA | 1633 | 39 | | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | PFHxS | 1633 | 480 | M-03 | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | PFHxA | 1633 | 54 | | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | PFNA | 1633 | 12 | M-03 | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | PFOSA | 1633 | 0.26 | JM-03 | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | PFOS | 1633 | 1800 | M-03 | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | PFOA | 1633 | 58 | M-03 | ng/L | 95 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 018 | VRTB-D-B1_10262023 | Aqueous | PFPeS | 1633 | 23 | | ng/L | 95 |
| 018 | VRTB-D-B1_10262023 | Aqueous | PFPeA | 1633 | 40 | | ng/L | 95 |
| 019 | VRTB-D-S2_10262023 | Aqueous | PFBS | 1633 | 17 | | ng/L | 97 |
| 019 | VRTB-D-S2_10262023 | Aqueous | PFBA | 1633 | 6.2 | | ng/L | 97 |
| 019 | VRTB-D-S2_10262023 | Aqueous | PFHpS | 1633 | 8.3 | | ng/L | 97 |
| 019 | VRTB-D-S2_10262023 | Aqueous | PFHpA | 1633 | 7.0 | | ng/L | 97 |
| 019 | VRTB-D-S2_10262023 | Aqueous | PFHxS | 1633 | 170 | M-03 | ng/L | 97 |
| 019 | VRTB-D-S2_10262023 | Aqueous | PFHxA | 1633 | 13 | | ng/L | 97 |
| 019 | VRTB-D-S2_10262023 | Aqueous | PFNA | 1633 | 0.75 | JM-03 | ng/L | 97 |
| 019 | VRTB-D-S2_10262023 | Aqueous | PFOS | 1633 | 290 | M-03 | ng/L | 97 |
| 019 | VRTB-D-S2_10262023 | Aqueous | PFOA | 1633 | 14 | M-03 | ng/L | 97 |
| 019 | VRTB-D-S2_10262023 | Aqueous | PFPeS | 1633 | 37 | | ng/L | 97 |
| 019 | VRTB-D-S2_10262023 | Aqueous | PFPeA | 1633 | 8.5 | | ng/L | 97 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | PFBS | 1633 | 2.7 | | ng/L | 99 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | PFBA | 1633 | 3.1 | JM-03 | ng/L | 99 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | PFHpS | 1633 | 2.3 | | ng/L | 99 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | PFHpA | 1633 | 2.3 | | ng/L | 99 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | PFHxS | 1633 | 51 | | ng/L | 99 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | PFHxA | 1633 | 3.6 | | ng/L | 99 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | PFNA | 1633 | 0.53 | JM-03 | ng/L | 99 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | PFOS | 1633 | 98 | M-03 | ng/L | 99 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | PFOA | 1633 | 4.3 | M-03 | ng/L | 99 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | PFPeS | 1633 | 7.0 | | ng/L | 99 |
| 020 | VRTB-D-Y3_10262023 | Aqueous | PFPeA | 1633 | 2.3 | M-03 | ng/L | 99 |
| 021 | VRTB-D-G4_10262023 | Aqueous | PFBS | 1633 | 0.92 | J | ng/L | 103 |
| 021 | VRTB-D-G4_10262023 | Aqueous | PFBA | 1633 | 5.5 | | ng/L | 103 |
| 021 | VRTB-D-G4_10262023 | Aqueous | PFHpS | 1633 | 1.7 | | ng/L | 103 |
| 021 | VRTB-D-G4_10262023 | Aqueous | PFHpA | 1633 | 3.1 | | ng/L | 103 |
| 021 | VRTB-D-G4_10262023 | Aqueous | PFHxS | 1633 | 34 | | ng/L | 103 |
| 021 | VRTB-D-G4_10262023 | Aqueous | PFHxA | 1633 | 8.3 | | ng/L | 103 |
| 021 | VRTB-D-G4_10262023 | Aqueous | PFNA | 1633 | 0.45 | JM-03 | ng/L | 103 |
| 021 | VRTB-D-G4_10262023 | Aqueous | PFOS | 1633 | 110 | M-03 | ng/L | 103 |
| 021 | VRTB-D-G4_10262023 | Aqueous | PFOA | 1633 | 3.2 | M-03 | ng/L | 103 |
| 021 | VRTB-D-G4_10262023 | Aqueous | PFPeS | 1633 | 2.0 | M-03 | ng/L | 103 |
| 021 | VRTB-D-G4_10262023 | Aqueous | PFPeA | 1633 | 12 | | ng/L | 103 |
| 022 | VRTB-S-06_10262023 | Aqueous | 8:2FTS | 1633 | 1.7 | JM-03 | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | 6:2FTS | 1633 | 2.6 | JM-03 | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFBS | 1633 | 8.0 | | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFBA | 1633 | 15 | | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFDS | 1633 | 0.20 | J | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFDA | 1633 | 0.76 | JM-03 | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFHpS | 1633 | 65 | M-03 | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFHpA | 1633 | 20 | | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFHxS | 1633 | 510 | M-03 | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFHxA | 1633 | 39 | M-03 | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFNS | 1633 | 0.75 | JM-03 | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFNA | 1633 | 8.1 | M-03 | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFOSA | 1633 | 4.9 | M-03 | ng/L | 107 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 022 | VRTB-S-06_10262023 | Aqueous | PFOS | 1633 | 1700 | M-03 | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFOA | 1633 | 42 | | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFPeS | 1633 | 29 | | ng/L | 107 |
| 022 | VRTB-S-06_10262023 | Aqueous | PFPeA | 1633 | 25 | | ng/L | 107 |
| 023 | VRTB-S-M5_10262023 | Aqueous | 8:2FTS | 1633 | 11 | | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | 6:2FTS | 1633 | 11 | M-03 | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFBS | 1633 | 5.0 | | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFBA | 1633 | 13 | | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFDA | 1633 | 0.25 | JM-03 | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFHpS | 1633 | 30 | | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFHpA | 1633 | 26 | | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFHxS | 1633 | 440 | | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFHxA | 1633 | 45 | M-03 | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFNA | 1633 | 11 | M-03 | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFOSA | 1633 | 0.48 | JM-03 | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFOS | 1633 | 2500 | M-03 | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFOA | 1633 | 47 | | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFPeS | 1633 | 16 | | ng/L | 109 |
| 023 | VRTB-S-M5_10262023 | Aqueous | PFPeA | 1633 | 29 | | ng/L | 109 |
| 024 | VRTB-S-R7_10262023 | Aqueous | 8:2FTS | 1633 | 63 | | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFBS | 1633 | 33 | | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFBA | 1633 | 71 | | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFDA | 1633 | 0.34 | JM-03 | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFHpS | 1633 | 300 | | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFHpA | 1633 | 160 | | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFHxA | 1633 | 300 | | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFNS | 1633 | 1.8 | M-03 | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFNA | 1633 | 73 | M-03 | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFOA | 1633 | 260 | | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFPeS | 1633 | 110 | | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFPeA | 1633 | 160 | | ng/L | 111 |
| 024 | VRTB-S-R7_10262023 | Aqueous | 6:2FTS | 1633 | 150 | HJ | ng/L | 113 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFHxS | 1633 | 2500 | H | ng/L | 113 |
| 024 | VRTB-S-R7_10262023 | Aqueous | PFOS | 1633 | 26000 | HM-03 | ng/L | 113 |
| 025 | VRTB-L-S2_10262023 | Aqueous | 8:2FTS | 1633 | 11 | | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | 6:2FTS | 1633 | 5.6 | | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFBS | 1633 | 5.1 | M-03 | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFBA | 1633 | 8.3 | | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFHpS | 1633 | 15 | M-03 | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFHpA | 1633 | 11 | | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFHxS | 1633 | 210 | M-03 | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFHxA | 1633 | 16 | M-03 | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFNA | 1633 | 5.4 | | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFOSA | 1633 | 1.2 | M-03 | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFOA | 1633 | 28 | | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFPeS | 1633 | 10 | M-03 | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFPeA | 1633 | 12 | | ng/L | 115 |
| 025 | VRTB-L-S2_10262023 | Aqueous | PFOS | 1633 | 920 | M-03 | ng/L | 117 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 026 | VRTB-L-G4_10262023 | Aqueous | 8:2FTS | 1633 | 78 | | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | 6:2FTS | 1633 | 67 | | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFBS | 1633 | 8.3 | | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFBA | 1633 | 27 | | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFDA | 1633 | 0.35 | JM-03 | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFHpS | 1633 | 75 | | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFHpA | 1633 | 69 | | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFHxA | 1633 | 79 | M-03 | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFNA | 1633 | 28 | M-03 | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFOSA | 1633 | 1.7 | | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFOA | 1633 | 140 | | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFPeS | 1633 | 23 | | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFPeA | 1633 | 64 | | ng/L | 121 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFHxS | 1633 | 570 | HM-03 | ng/L | 123 |
| 026 | VRTB-L-G4_10262023 | Aqueous | PFOS | 1633 | 4800 | HM-03 | ng/L | 123 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | 8:2FTS | 1633 | 140 | | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | 6:2FTS | 1633 | 11 | M-03 | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFBS | 1633 | 5.2 | | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFBA | 1633 | 9.8 | | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFDA | 1633 | 0.41 | JM-03 | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFHpS | 1633 | 45 | | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFHpA | 1633 | 20 | | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFHxS | 1633 | 370 | M-03 | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFHxA | 1633 | 26 | M-03 | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFNS | 1633 | 0.65 | JM-03 | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFNA | 1633 | 18 | | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFOSA | 1633 | 4.2 | M-03 | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFOS | 1633 | 3100 | M-03 | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFOA | 1633 | 43 | | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFPeS | 1633 | 14 | | ng/L | 125 |
| 027 | VRTB-L-Y3_10262023 | Aqueous | PFPeA | 1633 | 21 | | ng/L | 125 |
| 028 | VRTB-L-B1_10262023 | Aqueous | 8:2FTS | 1633 | 1.9 | J | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | PFBS | 1633 | 5.7 | | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | PFBA | 1633 | 7.0 | | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | PFHpS | 1633 | 12 | M-03 | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | PFHpA | 1633 | 7.7 | | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | PFHxS | 1633 | 140 | | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | PFHxA | 1633 | 13 | | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | PFNA | 1633 | 3.6 | | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | PFOS | 1633 | 540 | | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | PFOA | 1633 | 23 | M-03 | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | PFPeS | 1633 | 9.9 | | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | PFPeA | 1633 | 10 | | ng/L | 127 |
| 028 | VRTB-L-B1_10262023 | Aqueous | 3:3FTCA | 1633 | 1.1 | JM-03 | ng/L | 127 |
| 029 | DUP-01_10242023 | Aqueous | 8:2FTS | 1633 | 26 | M-03 | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | 6:2FTS | 1633 | 39 | | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFMPA | 1633 | 1.3 | J | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFBS | 1633 | 31 | | ng/L | 129 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 029 | DUP-01_10242023 | Aqueous | PFBA | 1633 | 48 | | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFDA | 1633 | 0.28 | J | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFHpS | 1633 | 160 | M-03 | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFHpA | 1633 | 89 | | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFHxA | 1633 | 220 | | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFNS | 1633 | 0.38 | JM-03 | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFNA | 1633 | 52 | M-03 | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFOSA | 1633 | 1.3 | M-03 | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFOA | 1633 | 150 | M-03 | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFPeS | 1633 | 85 | M-03 | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFPeA | 1633 | 91 | | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | 3:3FTCA | 1633 | 0.68 | JM-03 | ng/L | 129 |
| 029 | DUP-01_10242023 | Aqueous | PFHxS | 1633 | 1400 | M-03 | ng/L | 131 |
| 029 | DUP-01_10242023 | Aqueous | PFOS | 1633 | 14000 | HM-03 | ng/L | 133 |
| 030 | DUP-02_10252023 | Aqueous | PFBS | 1633 | 8.5 | | ng/L | 135 |
| 030 | DUP-02_10252023 | Aqueous | PFBA | 1633 | 9.0 | | ng/L | 135 |
| 030 | DUP-02_10252023 | Aqueous | PFHpS | 1633 | 24 | M-03 | ng/L | 135 |
| 030 | DUP-02_10252023 | Aqueous | PFHpA | 1633 | 8.3 | | ng/L | 135 |
| 030 | DUP-02_10252023 | Aqueous | PFHxS | 1633 | 500 | M-03 | ng/L | 135 |
| 030 | DUP-02_10252023 | Aqueous | PFHxA | 1633 | 18 | | ng/L | 135 |
| 030 | DUP-02_10252023 | Aqueous | PFNA | 1633 | 2.6 | M-03 | ng/L | 135 |
| 030 | DUP-02_10252023 | Aqueous | PFOS | 1633 | 1100 | M-03 | ng/L | 135 |
| 030 | DUP-02_10252023 | Aqueous | PFOA | 1633 | 15 | M-03 | ng/L | 135 |
| 030 | DUP-02_10252023 | Aqueous | PFPeS | 1633 | 22 | | ng/L | 135 |
| 030 | DUP-02_10252023 | Aqueous | PFPeA | 1633 | 9.0 | | ng/L | 135 |

(404 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-001
Description: CMT-VRTB-01_2_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1203
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1619 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 10 | 12/14/2023 1517 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1854 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.4 | U | 4.1 | 2.4 | 0.90 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.3 | U | 4.1 | 2.3 | 0.69 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.4 | U | 4.1 | 2.4 | 0.68 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 37 | M-03 | 4.1 | 1.5 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.1 | 1.5 | 0.41 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 140 | | 5.1 | 4.7 | 2.1 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 26 | 10 | 4.4 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.5 | U | 4.1 | 2.5 | 1.0 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | UQM-03 | 10 | 2.0 | 0.63 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | UQ | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | UQM-03 | 10 | 2.0 | 0.65 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.4 | U | 2.1 | 1.4 | 0.59 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.2 | U | 2.1 | 1.2 | 0.37 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.67 | U | 2.1 | 0.67 | 0.19 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.4 | U | 2.1 | 1.4 | 0.40 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 54 | | 1.0 | 0.35 | 0.096 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 120 | | 4.1 | 1.6 | 0.52 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.17 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | J | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 430 | M-03 | 1.0 | 0.38 | 0.20 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 240 | | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 26 | 10 | 4.3 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 3700 | EM-03 | 1.0 | 0.73 | 0.19 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 480 | | 1.0 | 0.40 | 0.15 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.2 | M-03 | 1.0 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 85 | M-03 | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.6 | QM-03 | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 27000 | EM-03 | 1.0 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 330 | M-03 | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 180 | | 1.0 | 0.75 | 0.26 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 270 | | 2.1 | 0.42 | 0.19 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.61 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.28 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-001
Description: CMT-VRTB-01_2_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1203
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 120 | 20-150 | | 91 | 20-150 | H | 74 | 20-150 |
| 13C2-6:2FTS | | 110 | 20-150 | | 82 | 20-150 | H | 72 | 20-150 |
| 13C2-8:2FTS | | 104 | 20-150 | | 71 | 20-150 | H | 70 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 | | 69 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | | 71 | 20-150 | | 62 | 20-150 | H | 74 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 | | 77 | 20-150 | H | 75 | 20-150 |
| 13C3-PFBS | | 117 | 20-150 | | 82 | 20-150 | H | 81 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 | | 76 | 20-150 | H | 73 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 | | 78 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 | | 84 | 20-150 | H | 82 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 | | 83 | 20-150 | H | 77 | 20-150 |
| 13C5-PFPeA | | 80 | 20-150 | | 79 | 20-150 | H | 79 | 20-150 |
| 13C6-PFDA | | 83 | 20-150 | M-03 | 76 | 20-150 | H | 75 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 | M-03 | 70 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOA | | 97 | 20-150 | | 90 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 | M-03 | 78 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOSA | N | 194 | 20-150 | | 102 | 20-150 | H | 79 | 20-150 |
| 13C9-PFNA | | 81 | 20-150 | | 90 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 148 | 20-150 | M-03 | 77 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | N | 175 | 20-150 | | 116 | 20-150 | H | 80 | 20-150 |
| D5-NEtFOSA | | 148 | 20-150 | | 82 | 20-150 | H | 60 | 20-150 |
| D5-NEtFOSAA | | 133 | 20-150 | M-03 | 91 | 20-150 | H | 77 | 20-150 |
| D7-NMeFOSE | N | 173 | 20-150 | | 93 | 20-150 | H | 73 | 20-150 |
| D9-NEtFOSE | N | 159 | 20-150 | | 87 | 20-150 | H | 71 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-001
Description: CMT-VRTB-01_2_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1203
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1619 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 10 | 12/14/2023 1517 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1854 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 24 | U | 41 | 24 | 9.0 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 23 | U | 41 | 23 | 6.9 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 24 | U | 41 | 24 | 6.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 36 | JM-03 | 41 | 15 | 6.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 15 | U | 41 | 15 | 4.1 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 120 | M-03 | 51 | 47 | 21 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 100 | U | 260 | 100 | 44 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 25 | U | 41 | 25 | 10 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 4.0 | U | 10 | 4.0 | 1.3 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 8.0 | U | 10 | 8.0 | 3.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 20 | U | 100 | 20 | 6.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 8.0 | U | 10 | 8.0 | 2.2 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 8.0 | U | 10 | 8.0 | 3.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 20 | U | 100 | 20 | 6.5 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 14 | U | 21 | 14 | 5.9 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 12 | U | 21 | 12 | 3.7 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 6.7 | U | 21 | 6.7 | 1.9 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 14 | U | 21 | 14 | 4.0 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 52 | | 10 | 3.5 | 0.96 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 120 | | 41 | 16 | 5.2 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.9 | U | 10 | 3.9 | 1.7 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 4.0 | U | 10 | 4.0 | 1.4 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.9 | U | 10 | 3.9 | 1.6 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 4.0 | U | 10 | 4.0 | 1.1 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 220 | | 10 | 3.8 | 2.0 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 240 | | 10 | 8.0 | 2.2 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 100 | U | 260 | 100 | 43 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 3800 | M-03 | 10 | 7.3 | 1.9 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 460 | | 10 | 4.0 | 1.5 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.8 | U | 10 | 3.8 | 1.5 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 89 | M-03 | 10 | 4.0 | 1.1 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.0 | JM-03 | 10 | 4.0 | 2.0 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 27000 | EM-03 | 10 | 7.4 | 2.5 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 370 | M-03 | 10 | 8.0 | 2.1 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 130 | | 10 | 7.5 | 2.6 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 260 | | 21 | 4.2 | 1.9 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 20 | U | 51 | 20 | 6.1 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 8.0 | U | 10 | 8.0 | 2.8 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 4.0 | U | 10 | 4.0 | 2.0 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 8.0 | U | 10 | 8.0 | 2.5 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-001
Description: CMT-VRTB-01_2_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1203
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 120 | 20-150 | | 91 | 20-150 | H | 74 | 20-150 |
| 13C2-6:2FTS | | 110 | 20-150 | | 82 | 20-150 | H | 72 | 20-150 |
| 13C2-8:2FTS | | 104 | 20-150 | | 71 | 20-150 | H | 70 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 | | 69 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | | 71 | 20-150 | | 62 | 20-150 | H | 74 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 | | 77 | 20-150 | H | 75 | 20-150 |
| 13C3-PFBS | | 117 | 20-150 | | 82 | 20-150 | H | 81 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 | | 76 | 20-150 | H | 73 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 | | 78 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 | | 84 | 20-150 | H | 82 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 | | 83 | 20-150 | H | 77 | 20-150 |
| 13C5-PFPeA | | 80 | 20-150 | | 79 | 20-150 | H | 79 | 20-150 |
| 13C6-PFDA | | 83 | 20-150 | M-03 | 76 | 20-150 | H | 75 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 | M-03 | 70 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOA | | 97 | 20-150 | | 90 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 | M-03 | 78 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOSA | N | 194 | 20-150 | | 102 | 20-150 | H | 79 | 20-150 |
| 13C9-PFNA | | 81 | 20-150 | | 90 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 148 | 20-150 | M-03 | 77 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | N | 175 | 20-150 | | 116 | 20-150 | H | 80 | 20-150 |
| D5-NEtFOSA | | 148 | 20-150 | | 82 | 20-150 | H | 60 | 20-150 |
| D5-NEtFOSAA | | 133 | 20-150 | M-03 | 91 | 20-150 | H | 77 | 20-150 |
| D7-NMeFOSE | N | 173 | 20-150 | | 93 | 20-150 | H | 73 | 20-150 |
| D9-NEtFOSE | N | 159 | 20-150 | | 87 | 20-150 | H | 71 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-001
Description: CMT-VRTB-01_2_10232023 | Matrix: Aqueous
Date Sampled: 10/23/2023 1203 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1619 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 10 | 12/14/2023 1517 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1854 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 41 | HJM-03 | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 270 | HM-03 | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 61 | HM-03 | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 120 | HJ | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 170 | HM-03 | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 240 | H | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 3800 | HSM-03 | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 470 | H | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 100 | HM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UHM-03 | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 26000 | HSM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 410 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 150 | H | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 260 | H | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-001
Description: CMT-VRTB-01_2_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1203
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 120 | 20-150 | | 91 | 20-150 | H | 74 | 20-150 |
| 13C2-6:2FTS | | 110 | 20-150 | | 82 | 20-150 | H | 72 | 20-150 |
| 13C2-8:2FTS | | 104 | 20-150 | | 71 | 20-150 | H | 70 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 | | 69 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | | 71 | 20-150 | | 62 | 20-150 | H | 74 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 | | 77 | 20-150 | H | 75 | 20-150 |
| 13C3-PFBS | | 117 | 20-150 | | 82 | 20-150 | H | 81 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 | | 76 | 20-150 | H | 73 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 | | 78 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 | | 84 | 20-150 | H | 82 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 | | 83 | 20-150 | H | 77 | 20-150 |
| 13C5-PFPeA | | 80 | 20-150 | | 79 | 20-150 | H | 79 | 20-150 |
| 13C6-PFDA | | 83 | 20-150 | M-03 | 76 | 20-150 | H | 75 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 | M-03 | 70 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOA | | 97 | 20-150 | | 90 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 | M-03 | 78 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOSA | N | 194 | 20-150 | | 102 | 20-150 | H | 79 | 20-150 |
| 13C9-PFNA | | 81 | 20-150 | | 90 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 148 | 20-150 | M-03 | 77 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | N | 175 | 20-150 | | 116 | 20-150 | H | 80 | 20-150 |
| D5-NEtFOSA | | 148 | 20-150 | | 82 | 20-150 | H | 60 | 20-150 |
| D5-NEtFOSAA | | 133 | 20-150 | M-03 | 91 | 20-150 | H | 77 | 20-150 |
| D7-NMeFOSE | N | 173 | 20-150 | | 93 | 20-150 | H | 73 | 20-150 |
| D9-NEtFOSE | N | 159 | 20-150 | | 87 | 20-150 | H | 71 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-002
Description: CMT-VRTB-01_3_10232023 | Matrix: Aqueous
Date Sampled: 10/23/2023 1330 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1628 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1526 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1921 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.65 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 24 | | 3.9 | 1.5 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 37 | | 4.8 | 4.4 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.96 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.7 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.7 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.56 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 14 | | 0.97 | 0.34 | 0.091 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 49 | | 3.9 | 1.6 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 73 | | 0.97 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 88 | | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 910 | EM-03 | 0.97 | 0.71 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 150 | | 0.97 | 0.39 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.15 | JM-03 | 0.97 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 37 | M-03 | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.72 | JM-03 | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 7900 | EM-03 | 0.97 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 110 | M-03 | 0.97 | 0.78 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 29 | | 0.97 | 0.73 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 110 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.58 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-002
Description: CMT-VRTB-01_3_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1330
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 | | 77 | 20-150 | H | 79 | 20-150 |
| 13C2-6:2FTS | | 83 | 20-150 | | 66 | 20-150 | H | 76 | 20-150 |
| 13C2-8:2FTS | | 82 | 20-150 | M-03 | 73 | 20-150 | H | 69 | 20-150 |
| 13C2-PFDoA | | 71 | 20-150 | | 66 | 20-150 | H | 87 | 20-150 |
| 13C2-PFTeDA | | 67 | 20-150 | | 56 | 20-150 | H | 78 | 20-150 |
| 13C3-HFPO-DA | | 76 | 20-150 | | 74 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 83 | 20-150 | | 73 | 20-150 | H | 79 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 | | 75 | 20-150 | H | 75 | 20-150 |
| 13C4-PFBA | | 75 | 20-150 | | 76 | 20-150 | H | 79 | 20-150 |
| 13C4-PFHpA | | 74 | 20-150 | | 69 | 20-150 | H | 78 | 20-150 |
| 13C5-PFHxA | | 72 | 20-150 | | 72 | 20-150 | H | 77 | 20-150 |
| 13C5-PFPeA | | 73 | 20-150 | | 70 | 20-150 | H | 84 | 20-150 |
| 13C6-PFDA | | 83 | 20-150 | | 70 | 20-150 | H | 81 | 20-150 |
| 13C7-PFUnA | | 80 | 20-150 | | 64 | 20-150 | H | 76 | 20-150 |
| 13C8-PFOA | | 72 | 20-150 | M-03 | 82 | 20-150 | H | 76 | 20-150 |
| 13C8-PFOS | | 71 | 20-150 | | 72 | 20-150 | H | 76 | 20-150 |
| 13C8-PFOSA | | 123 | 20-150 | | 92 | 20-150 | H | 82 | 20-150 |
| 13C9-PFNA | | 71 | 20-150 | | 62 | 20-150 | H | 72 | 20-150 |
| D3-NMeFOSA | | 84 | 20-150 | | 58 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 122 | 20-150 | | 88 | 20-150 | H | 84 | 20-150 |
| D5-NEtFOSA | | 84 | 20-150 | | 62 | 20-150 | H | 57 | 20-150 |
| D5-NEtFOSAA | | 106 | 20-150 | | 90 | 20-150 | H | 81 | 20-150 |
| D7-NMeFOSE | | 103 | 20-150 | | 75 | 20-150 | H | 78 | 20-150 |
| D9-NEtFOSE | | 95 | 20-150 | | 68 | 20-150 | H | 76 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-002
Description: CMT-VRTB-01_3_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1330
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1628 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1526 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1921 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.2 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.2 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.2 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 28 | | 19 | 7.1 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 35 | M-03 | 24 | 22 | 9.8 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.62 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.6 | U | 48 | 9.6 | 2.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.6 | U | 48 | 9.6 | 3.0 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.3 | U | 9.7 | 6.3 | 2.8 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.3 | U | 9.7 | 5.3 | 1.7 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.1 | U | 9.7 | 3.1 | 0.89 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.3 | U | 9.7 | 6.3 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 14 | | 4.8 | 1.7 | 0.45 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 49 | | 19 | 7.6 | 2.5 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.80 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.65 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.75 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.52 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 61 | | 4.8 | 1.8 | 0.92 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 92 | | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 870 | M-03 | 4.8 | 3.5 | 0.89 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 150 | | 4.8 | 1.9 | 0.69 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.8 | U | 4.8 | 1.8 | 0.70 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 41 | | 4.8 | 1.9 | 0.50 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.9 | UM-03 | 4.8 | 1.9 | 0.96 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 7300 | EM-03 | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 110 | M-03 | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 25 | | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 110 | | 9.7 | 1.9 | 0.89 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.9 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.94 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-002
Description: CMT-VRTB-01_3_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1330
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 | | 77 | 20-150 | H | 79 | 20-150 |
| 13C2-6:2FTS | | 83 | 20-150 | | 66 | 20-150 | H | 76 | 20-150 |
| 13C2-8:2FTS | | 82 | 20-150 | M-03 | 73 | 20-150 | H | 69 | 20-150 |
| 13C2-PFDoA | | 71 | 20-150 | | 66 | 20-150 | H | 87 | 20-150 |
| 13C2-PFTeDA | | 67 | 20-150 | | 56 | 20-150 | H | 78 | 20-150 |
| 13C3-HFPO-DA | | 76 | 20-150 | | 74 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 83 | 20-150 | | 73 | 20-150 | H | 79 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 | | 75 | 20-150 | H | 75 | 20-150 |
| 13C4-PFBA | | 75 | 20-150 | | 76 | 20-150 | H | 79 | 20-150 |
| 13C4-PFHpA | | 74 | 20-150 | | 69 | 20-150 | H | 78 | 20-150 |
| 13C5-PFHxA | | 72 | 20-150 | | 72 | 20-150 | H | 77 | 20-150 |
| 13C5-PFPeA | | 73 | 20-150 | | 70 | 20-150 | H | 84 | 20-150 |
| 13C6-PFDA | | 83 | 20-150 | | 70 | 20-150 | H | 81 | 20-150 |
| 13C7-PFUnA | | 80 | 20-150 | | 64 | 20-150 | H | 76 | 20-150 |
| 13C8-PFOA | | 72 | 20-150 | M-03 | 82 | 20-150 | H | 76 | 20-150 |
| 13C8-PFOS | | 71 | 20-150 | | 72 | 20-150 | H | 76 | 20-150 |
| 13C8-PFOSA | | 123 | 20-150 | | 92 | 20-150 | H | 82 | 20-150 |
| 13C9-PFNA | | 71 | 20-150 | | 62 | 20-150 | H | 72 | 20-150 |
| D3-NMeFOSA | | 84 | 20-150 | | 58 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 122 | 20-150 | | 88 | 20-150 | H | 84 | 20-150 |
| D5-NEtFOSA | | 84 | 20-150 | | 62 | 20-150 | H | 57 | 20-150 |
| D5-NEtFOSAA | | 106 | 20-150 | | 90 | 20-150 | H | 81 | 20-150 |
| D7-NMeFOSE | | 103 | 20-150 | | 75 | 20-150 | H | 78 | 20-150 |
| D9-NEtFOSE | | 95 | 20-150 | | 68 | 20-150 | H | 76 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-002
Description: CMT-VRTB-01_3_10232023 | Matrix: Aqueous
Date Sampled: 10/23/2023 1330 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1628 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1526 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1921 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 46 | UH | 80 | 46 | 17 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 44 | UH | 80 | 44 | 13 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 46 | UH | 80 | 46 | 13 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 30 | UH | 80 | 30 | 12 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 30 | UH | 80 | 30 | 8.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 530 | H | 100 | 92 | 40 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 200 | UH | 500 | 200 | 86 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 48 | UH | 80 | 48 | 20 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.6 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 16 | UH | 20 | 16 | 5.8 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 40 | UH | 200 | 40 | 12 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 16 | UH | 20 | 16 | 4.3 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 16 | UH | 20 | 16 | 5.9 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 40 | UH | 200 | 40 | 13 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 26 | UH | 40 | 26 | 12 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 22 | UH | 40 | 22 | 7.2 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 13 | UH | 40 | 13 | 3.7 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 26 | UH | 40 | 26 | 7.8 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 15 | HJM-03 | 20 | 7.0 | 1.9 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 53 | HJ | 80 | 32 | 10 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 7.8 | UH | 20 | 7.8 | 3.3 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.7 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 7.8 | UH | 20 | 7.8 | 3.1 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 8.0 | UH | 20 | 8.0 | 2.1 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 50 | HM-03 | 20 | 7.6 | 3.8 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 93 | H | 20 | 16 | 4.3 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 200 | UH | 500 | 200 | 84 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1000 | HM-03 | 20 | 15 | 3.7 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 170 | H | 20 | 8.0 | 2.8 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 7.6 | UH | 20 | 7.6 | 2.9 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 41 | H | 20 | 8.0 | 2.1 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 8.0 | UH | 20 | 8.0 | 4.0 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 7500 | HM-03 | 20 | 15 | 4.9 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 140 | HM-03 | 20 | 16 | 4.2 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 32 | HM-03 | 20 | 15 | 5.1 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 110 | H | 40 | 8.0 | 3.7 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 40 | UH | 100 | 40 | 12 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 16 | UH | 20 | 16 | 5.4 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 8.0 | UH | 20 | 8.0 | 3.9 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 16 | UH | 20 | 16 | 5.0 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-002
Description: CMT-VRTB-01_3_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1330
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 | | 77 | 20-150 | H | 79 | 20-150 |
| 13C2-6:2FTS | | 83 | 20-150 | | 66 | 20-150 | H | 76 | 20-150 |
| 13C2-8:2FTS | | 82 | 20-150 | M-03 | 73 | 20-150 | H | 69 | 20-150 |
| 13C2-PFDoA | | 71 | 20-150 | | 66 | 20-150 | H | 87 | 20-150 |
| 13C2-PFTeDA | | 67 | 20-150 | | 56 | 20-150 | H | 78 | 20-150 |
| 13C3-HFPO-DA | | 76 | 20-150 | | 74 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 83 | 20-150 | | 73 | 20-150 | H | 79 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 | | 75 | 20-150 | H | 75 | 20-150 |
| 13C4-PFBA | | 75 | 20-150 | | 76 | 20-150 | H | 79 | 20-150 |
| 13C4-PFHpA | | 74 | 20-150 | | 69 | 20-150 | H | 78 | 20-150 |
| 13C5-PFHxA | | 72 | 20-150 | | 72 | 20-150 | H | 77 | 20-150 |
| 13C5-PFPeA | | 73 | 20-150 | | 70 | 20-150 | H | 84 | 20-150 |
| 13C6-PFDA | | 83 | 20-150 | | 70 | 20-150 | H | 81 | 20-150 |
| 13C7-PFUnA | | 80 | 20-150 | | 64 | 20-150 | H | 76 | 20-150 |
| 13C8-PFOA | | 72 | 20-150 | M-03 | 82 | 20-150 | H | 76 | 20-150 |
| 13C8-PFOS | | 71 | 20-150 | | 72 | 20-150 | H | 76 | 20-150 |
| 13C8-PFOSA | | 123 | 20-150 | | 92 | 20-150 | H | 82 | 20-150 |
| 13C9-PFNA | | 71 | 20-150 | | 62 | 20-150 | H | 72 | 20-150 |
| D3-NMeFOSA | | 84 | 20-150 | | 58 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 122 | 20-150 | | 88 | 20-150 | H | 84 | 20-150 |
| D5-NEtFOSA | | 84 | 20-150 | | 62 | 20-150 | H | 57 | 20-150 |
| D5-NEtFOSAA | | 106 | 20-150 | | 90 | 20-150 | H | 81 | 20-150 |
| D7-NMeFOSE | | 103 | 20-150 | | 75 | 20-150 | H | 78 | 20-150 |
| D9-NEtFOSE | | 95 | 20-150 | | 68 | 20-150 | H | 76 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-003
Description: CMT-VRTB-01_4_10232023 | Matrix: Aqueous
Date Sampled: 10/23/2023 1435 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1637 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1535 | ALM | 11/16/2023 1218 | 90185 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.4 | U | 4.1 | 2.4 | 0.89 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.3 | U | 4.1 | 2.3 | 0.68 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.4 | U | 4.1 | 2.4 | 0.68 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 4.1 | 1.5 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.1 | 1.5 | 0.41 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 13 | | 5.1 | 4.7 | 2.1 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 26 | 10 | 4.4 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.5 | U | 4.1 | 2.5 | 1.0 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 10 | 2.0 | 0.62 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 10 | 2.0 | 0.64 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.59 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.37 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.19 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.40 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 11 | | 1.0 | 0.35 | 0.096 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 17 | | 4.1 | 1.6 | 0.52 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.17 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 22 | M-03 | 1.0 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 28 | | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 26 | 10 | 4.3 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 340 | M-03 | 1.0 | 0.73 | 0.19 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 34 | | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 1.0 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 9.9 | M-03 | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1200 | M-03 | 5.1 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 41 | M-03 | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 17 | | 1.0 | 0.75 | 0.26 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 27 | | 2.0 | 0.40 | 0.19 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.61 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-003
Description: CMT-VRTB-01_4_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1435
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 82 | 20-150 | | 73 | 20-150 |
| 13C2-6:2FTS | | 75 | 20-150 | | 74 | 20-150 |
| 13C2-8:2FTS | | 69 | 20-150 | | 72 | 20-150 |
| 13C2-PFDoA | | 74 | 20-150 | | 74 | 20-150 |
| 13C2-PFTeDA | | 66 | 20-150 | | 65 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 81 | 20-150 |
| 13C3-PFBS | | 81 | 20-150 | | 75 | 20-150 |
| 13C3-PFHxS | | 77 | 20-150 | | 73 | 20-150 |
| 13C4-PFBA | | 77 | 20-150 | | 78 | 20-150 |
| 13C4-PFHpA | | 79 | 20-150 | | 80 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 | | 78 | 20-150 |
| 13C5-PFPeA | | 78 | 20-150 | | 81 | 20-150 |
| 13C6-PFDA | | 80 | 20-150 | | 81 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 | M-03 | 72 | 20-150 |
| 13C8-PFOA | | 77 | 20-150 | | 82 | 20-150 |
| 13C8-PFOS | | 74 | 20-150 | | 76 | 20-150 |
| 13C8-PFOSA | | 82 | 20-150 | | 78 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 | | 87 | 20-150 |
| D3-NMeFOSA | | 58 | 20-150 | | 56 | 20-150 |
| D3-NMeFOSAA | | 82 | 20-150 | | 76 | 20-150 |
| D5-NEtFOSA | | 60 | 20-150 | | 55 | 20-150 |
| D5-NEtFOSAA | | 76 | 20-150 | M-03 | 70 | 20-150 |
| D7-NMeFOSE | | 72 | 20-150 | | 68 | 20-150 |
| D9-NEtFOSE | | 67 | 20-150 | | 64 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-004
Description: CMT-VRTB-01_5_10232023 | Matrix: Aqueous
Date Sampled: 10/23/2023 1545 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1646 | ALM | 11/16/2023 1218 | 90185 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.88 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | U | 4.0 | 2.2 | 0.67 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.67 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.40 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.6 | U | 5.0 | 4.6 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.3 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | U | 4.0 | 2.4 | 1.0 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 10 | 2.0 | 0.61 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 10 | 2.0 | 0.63 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.58 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.36 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.19 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.39 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 8.2 | | 1.0 | 0.35 | 0.094 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 10 | | 4.0 | 1.6 | 0.51 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 8.1 | | 1.0 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 10 | | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.2 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 130 | | 1.0 | 0.73 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 15 | | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 1.0 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.7 | | 1.0 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 280 | SM-03 | 1.0 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 16 | M-03 | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 11 | | 1.0 | 0.75 | 0.26 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 12 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.60 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-004
Description: CMT-VRTB-01_5_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1545
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 78 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 |
| 13C2-8:2FTS | | 73 | 20-150 |
| 13C2-PFDoA | | 71 | 20-150 |
| 13C2-PFTeDA | | 62 | 20-150 |
| 13C3-HFPO-DA | | 83 | 20-150 |
| 13C3-PFBS | | 83 | 20-150 |
| 13C3-PFHxS | | 79 | 20-150 |
| 13C4-PFBA | | 82 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 |
| 13C5-PFPeA | | 79 | 20-150 |
| 13C6-PFDA | | 74 | 20-150 |
| 13C7-PFUnA | | 70 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 |
| 13C8-PFOSA | | 81 | 20-150 |
| 13C9-PFNA | | 77 | 20-150 |
| D3-NMeFOSA | | 49 | 20-150 |
| D3-NMeFOSAA | | 77 | 20-150 |
| D5-NEtFOSA | | 50 | 20-150 |
| D5-NEtFOSAA | | 69 | 20-150 |
| D7-NMeFOSE | | 74 | 20-150 |
| D9-NEtFOSE | | 68 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-005

Description: VRTB-L-M5_10232023 | Matrix: Aqueous

Date Sampled: 10/23/2023 1725 | Project Name: Grayling GWS

Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1713 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1544 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1931 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.4 | U | 4.1 | 2.4 | 0.89 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.3 | U | 4.1 | 2.3 | 0.68 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.4 | UM-03 | 4.1 | 2.4 | 0.67 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 73 | | 4.1 | 1.5 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.1 | 1.5 | 0.40 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 120 | | 5.1 | 4.7 | 2.1 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.4 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.5 | U | 4.1 | 2.5 | 1.0 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 10 | 2.0 | 0.62 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 10 | 2.0 | 0.64 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.59 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.37 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.19 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.39 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 18 | | 1.0 | 0.35 | 0.095 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 90 | | 4.1 | 1.6 | 0.52 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.17 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 150 | | 1.0 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 240 | | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.2 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1700 | EM-03 | 1.0 | 0.73 | 0.19 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 270 | | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 1.0 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 63 | M-03 | 1.0 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.3 | M-03 | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 14000 | EM-03 | 1.0 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 240 | M-03 | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 60 | | 1.0 | 0.75 | 0.26 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 210 | | 2.0 | 0.40 | 0.19 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 0.86 | JM-03 | 5.1 | 2.0 | 0.60 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-005
Description: VRTB-L-M5_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1725
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 | | 82 | 20-150 | H | 74 | 20-150 |
| 13C2-6:2FTS | | 88 | 20-150 | | 95 | 20-150 | H | 76 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | M-03 | 76 | 20-150 | H | 71 | 20-150 |
| 13C2-PFDoA | | 65 | 20-150 | | 67 | 20-150 | H | 72 | 20-150 |
| 13C2-PFTeDA | | 44 | 20-150 | | 45 | 20-150 | H | 74 | 20-150 |
| 13C3-HFPO-DA | | 78 | 20-150 | | 83 | 20-150 | H | 76 | 20-150 |
| 13C3-PFBS | | 93 | 20-150 | | 79 | 20-150 | H | 79 | 20-150 |
| 13C3-PFHxS | | 76 | 20-150 | | 71 | 20-150 | H | 75 | 20-150 |
| 13C4-PFBA | | 75 | 20-150 | | 77 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 73 | 20-150 | | 71 | 20-150 | H | 73 | 20-150 |
| 13C5-PFHxA | | 74 | 20-150 | | 75 | 20-150 | H | 74 | 20-150 |
| 13C5-PFPeA | | 75 | 20-150 | | 76 | 20-150 | H | 77 | 20-150 |
| 13C6-PFDA | | 86 | 20-150 | M-03 | 89 | 20-150 | H | 76 | 20-150 |
| 13C7-PFUnA | | 74 | 20-150 | M-03 | 73 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOA | | 74 | 20-150 | | 74 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOS | | 69 | 20-150 | M-03 | 75 | 20-150 | H | 77 | 20-150 |
| 13C8-PFOSA | | 126 | 20-150 | | 93 | 20-150 | H | 75 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 | | 77 | 20-150 | H | 79 | 20-150 |
| D3-NMeFOSA | | 100 | 20-150 | | 78 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 129 | 20-150 | | 100 | 20-150 | H | 77 | 20-150 |
| D5-NEtFOSA | | 97 | 20-150 | | 69 | 20-150 | H | 54 | 20-150 |
| D5-NEtFOSAA | | 106 | 20-150 | M-03 | 77 | 20-150 | H | 95 | 20-150 |
| D7-NMeFOSE | | 82 | 20-150 | | 60 | 20-150 | H | 72 | 20-150 |
| D9-NEtFOSE | | 66 | 20-150 | | 49 | 20-150 | H | 69 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-005

Description: VRTB-L-M5_10232023 | Matrix: Aqueous

Date Sampled: 10/23/2023 1725 | Project Name: Grayling GWS

Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1713 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1544 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1931 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.4 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.4 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.4 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 74 | | 20 | 7.5 | 3.1 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 110 | | 25 | 23 | 10 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | U | 130 | 52 | 22 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 5.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.65 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.1 | U | 5.1 | 4.1 | 1.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | U | 51 | 10 | 3.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.1 | U | 5.1 | 4.1 | 1.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.1 | U | 5.1 | 4.1 | 1.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | U | 51 | 10 | 3.2 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | U | 10 | 6.5 | 2.9 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | U | 10 | 5.5 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | U | 10 | 3.2 | 0.94 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | U | 10 | 6.5 | 2.0 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 17 | | 5.1 | 1.8 | 0.48 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 97 | M-03 | 20 | 8.0 | 2.6 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.83 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.69 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.78 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.54 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 110 | | 5.1 | 1.9 | 0.96 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 260 | | 5.1 | 4.1 | 1.1 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1700 | M-03 | 5.1 | 3.7 | 0.94 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 270 | | 5.1 | 2.0 | 0.72 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 5.1 | 1.9 | 0.74 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 53 | | 5.1 | 2.0 | 0.52 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.5 | JM-03 | 5.1 | 2.0 | 1.0 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 13000 | EM-03 | 5.1 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 250 | M-03 | 5.1 | 4.1 | 1.1 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 58 | | 5.1 | 3.8 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 210 | | 10 | 2.0 | 0.94 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | U | 25 | 10 | 3.0 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.1 | U | 5.1 | 4.1 | 1.4 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.99 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.1 | U | 5.1 | 4.1 | 1.3 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-005
Description: VRTB-L-M5_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1725
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 | | 82 | 20-150 | H | 74 | 20-150 |
| 13C2-6:2FTS | | 88 | 20-150 | | 95 | 20-150 | H | 76 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | M-03 | 76 | 20-150 | H | 71 | 20-150 |
| 13C2-PFDoA | | 65 | 20-150 | | 67 | 20-150 | H | 72 | 20-150 |
| 13C2-PFTeDA | | 44 | 20-150 | | 45 | 20-150 | H | 74 | 20-150 |
| 13C3-HFPO-DA | | 78 | 20-150 | | 83 | 20-150 | H | 76 | 20-150 |
| 13C3-PFBS | | 93 | 20-150 | | 79 | 20-150 | H | 79 | 20-150 |
| 13C3-PFHxS | | 76 | 20-150 | | 71 | 20-150 | H | 75 | 20-150 |
| 13C4-PFBA | | 75 | 20-150 | | 77 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 73 | 20-150 | | 71 | 20-150 | H | 73 | 20-150 |
| 13C5-PFHxA | | 74 | 20-150 | | 75 | 20-150 | H | 74 | 20-150 |
| 13C5-PFPeA | | 75 | 20-150 | | 76 | 20-150 | H | 77 | 20-150 |
| 13C6-PFDA | | 86 | 20-150 | M-03 | 89 | 20-150 | H | 76 | 20-150 |
| 13C7-PFUnA | | 74 | 20-150 | M-03 | 73 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOA | | 74 | 20-150 | | 74 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOS | | 69 | 20-150 | M-03 | 75 | 20-150 | H | 77 | 20-150 |
| 13C8-PFOSA | | 126 | 20-150 | | 93 | 20-150 | H | 75 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 | | 77 | 20-150 | H | 79 | 20-150 |
| D3-NMeFOSA | | 100 | 20-150 | | 78 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 129 | 20-150 | | 100 | 20-150 | H | 77 | 20-150 |
| D5-NEtFOSA | | 97 | 20-150 | | 69 | 20-150 | H | 54 | 20-150 |
| D5-NEtFOSAA | | 106 | 20-150 | M-03 | 77 | 20-150 | H | 95 | 20-150 |
| D7-NMeFOSE | | 82 | 20-150 | | 60 | 20-150 | H | 72 | 20-150 |
| D9-NEtFOSE | | 66 | 20-150 | | 49 | 20-150 | H | 69 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-005
Description: VRTB-L-M5_10232023 | Matrix: Aqueous
Date Sampled: 10/23/2023 1725 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1713 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1544 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1931 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 79 | HJM-03 | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 190 | HJM-03 | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 18 | HJM-03 | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 100 | HJ | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 79 | HM-03 | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 280 | HM-03 | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1700 | H | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 280 | H | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 59 | HM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 12000 | HM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 290 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 62 | H | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 230 | H | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-005
Description: VRTB-L-M5_10232023
Matrix: Aqueous
Date Sampled: 10/23/2023 1725
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 | | 82 | 20-150 | H | 74 | 20-150 |
| 13C2-6:2FTS | | 88 | 20-150 | | 95 | 20-150 | H | 76 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | M-03 | 76 | 20-150 | H | 71 | 20-150 |
| 13C2-PFDoA | | 65 | 20-150 | | 67 | 20-150 | H | 72 | 20-150 |
| 13C2-PFTeDA | | 44 | 20-150 | | 45 | 20-150 | H | 74 | 20-150 |
| 13C3-HFPO-DA | | 78 | 20-150 | | 83 | 20-150 | H | 76 | 20-150 |
| 13C3-PFBS | | 93 | 20-150 | | 79 | 20-150 | H | 79 | 20-150 |
| 13C3-PFHxS | | 76 | 20-150 | | 71 | 20-150 | H | 75 | 20-150 |
| 13C4-PFBA | | 75 | 20-150 | | 77 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 73 | 20-150 | | 71 | 20-150 | H | 73 | 20-150 |
| 13C5-PFHxA | | 74 | 20-150 | | 75 | 20-150 | H | 74 | 20-150 |
| 13C5-PFPeA | | 75 | 20-150 | | 76 | 20-150 | H | 77 | 20-150 |
| 13C6-PFDA | | 86 | 20-150 | M-03 | 89 | 20-150 | H | 76 | 20-150 |
| 13C7-PFUnA | | 74 | 20-150 | M-03 | 73 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOA | | 74 | 20-150 | | 74 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOS | | 69 | 20-150 | M-03 | 75 | 20-150 | H | 77 | 20-150 |
| 13C8-PFOSA | | 126 | 20-150 | | 93 | 20-150 | H | 75 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 | | 77 | 20-150 | H | 79 | 20-150 |
| D3-NMeFOSA | | 100 | 20-150 | | 78 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 129 | 20-150 | | 100 | 20-150 | H | 77 | 20-150 |
| D5-NEtFOSA | | 97 | 20-150 | | 69 | 20-150 | H | 54 | 20-150 |
| D5-NEtFOSAA | | 106 | 20-150 | M-03 | 77 | 20-150 | H | 95 | 20-150 |
| D7-NMeFOSE | | 82 | 20-150 | | 60 | 20-150 | H | 72 | 20-150 |
| D9-NEtFOSE | | 66 | 20-150 | | 49 | 20-150 | H | 69 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-006
Description: VRTB-L-06_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 0923 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1723 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1554 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1940 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.4 | U | 4.1 | 2.4 | 0.89 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.3 | U | 4.1 | 2.3 | 0.68 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.4 | U | 4.1 | 2.4 | 0.67 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 70 | | 4.1 | 1.5 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.1 | 1.5 | 0.40 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 140 | | 5.1 | 4.7 | 2.1 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.4 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.5 | U | 4.1 | 2.5 | 1.0 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 10 | 2.0 | 0.62 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 10 | 2.0 | 0.64 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.59 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.37 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.19 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.39 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 15 | | 1.0 | 0.35 | 0.095 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 80 | M-03 | 4.1 | 1.6 | 0.52 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.17 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.70 | JM-03 | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 180 | | 1.0 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 180 | | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.2 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2000 | EM-03 | 1.0 | 0.73 | 0.19 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 220 | | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 1.0 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 86 | M-03 | 1.0 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.3 | M-03 | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 17000 | EM-03 | 1.0 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 220 | M-03 | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 70 | M-03 | 1.0 | 0.75 | 0.26 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 150 | | 2.0 | 0.40 | 0.19 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.60 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-006
Description: VRTB-L-06_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 0923
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 96 | 20-150 | | 80 | 20-150 | H | 67 | 20-150 |
| 13C2-6:2FTS | | 92 | 20-150 | | 75 | 20-150 | H | 69 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | | 86 | 20-150 | H | 68 | 20-150 |
| 13C2-PFDoA | | 63 | 20-150 | | 62 | 20-150 | H | 80 | 20-150 |
| 13C2-PFTeDA | | 44 | 20-150 | | 44 | 20-150 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 76 | 20-150 | | 74 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 | | 82 | 20-150 | H | 73 | 20-150 |
| 13C3-PFHxS | | 71 | 20-150 | | 73 | 20-150 | H | 71 | 20-150 |
| 13C4-PFBA | | 76 | 20-150 | | 76 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 67 | 20-150 | | 82 | 20-150 | H | 81 | 20-150 |
| 13C5-PFHxA | | 73 | 20-150 | | 77 | 20-150 | H | 83 | 20-150 |
| 13C5-PFPeA | | 73 | 20-150 | | 75 | 20-150 | H | 84 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 | | 74 | 20-150 | H | 70 | 20-150 |
| 13C7-PFUnA | | 68 | 20-150 | | 63 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOA | | 81 | 20-150 | | 58 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOS | | 70 | 20-150 | | 77 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOSA | | 135 | 20-150 | | 93 | 20-150 | H | 81 | 20-150 |
| 13C9-PFNA | | 72 | 20-150 | M-03 | 73 | 20-150 | H | 80 | 20-150 |
| D3-NMeFOSA | | 104 | 20-150 | | 75 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 128 | 20-150 | | 95 | 20-150 | H | 79 | 20-150 |
| D5-NEtFOSA | | 95 | 20-150 | | 66 | 20-150 | H | 56 | 20-150 |
| D5-NEtFOSAA | | 106 | 20-150 | | 83 | 20-150 | H | 103 | 20-150 |
| D7-NMeFOSE | | 65 | 20-150 | | 45 | 20-150 | H | 75 | 20-150 |
| D9-NEtFOSE | | 45 | 20-150 | | 32 | 20-150 | H | 73 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-006
Description: VRTB-L-06_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 0923 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1723 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1554 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1940 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.4 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.4 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.4 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 61 | | 20 | 7.5 | 3.1 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 140 | | 25 | 23 | 10 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | U | 130 | 52 | 22 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 5.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.65 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.1 | U | 5.1 | 4.1 | 1.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | U | 51 | 10 | 3.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.1 | U | 5.1 | 4.1 | 1.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.1 | U | 5.1 | 4.1 | 1.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | U | 51 | 10 | 3.2 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | U | 10 | 6.5 | 2.9 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | U | 10 | 5.5 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | U | 10 | 3.2 | 0.94 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | U | 10 | 6.5 | 2.0 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 15 | | 5.1 | 1.8 | 0.48 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 80 | | 20 | 8.0 | 2.6 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.83 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.69 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.78 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.54 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 120 | | 5.1 | 1.9 | 0.96 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 150 | | 5.1 | 4.1 | 1.1 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1700 | M-03 | 5.1 | 3.7 | 0.94 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 220 | | 5.1 | 2.0 | 0.72 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 5.1 | 1.9 | 0.74 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 78 | | 5.1 | 2.0 | 0.52 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.3 | JM-03 | 5.1 | 2.0 | 1.0 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 16000 | EM-03 | 5.1 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 230 | M-03 | 5.1 | 4.1 | 1.1 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 53 | | 5.1 | 3.8 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 150 | | 10 | 2.0 | 0.94 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | U | 25 | 10 | 3.0 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.1 | U | 5.1 | 4.1 | 1.4 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 5.1 | 2.0 | 0.99 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.1 | U | 5.1 | 4.1 | 1.3 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-006
Description: VRTB-L-06_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 0923
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 96 | 20-150 | | 80 | 20-150 | H | 67 | 20-150 |
| 13C2-6:2FTS | | 92 | 20-150 | | 75 | 20-150 | H | 69 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | | 86 | 20-150 | H | 68 | 20-150 |
| 13C2-PFDoA | | 63 | 20-150 | | 62 | 20-150 | H | 80 | 20-150 |
| 13C2-PFTeDA | | 44 | 20-150 | | 44 | 20-150 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 76 | 20-150 | | 74 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 | | 82 | 20-150 | H | 73 | 20-150 |
| 13C3-PFHxS | | 71 | 20-150 | | 73 | 20-150 | H | 71 | 20-150 |
| 13C4-PFBA | | 76 | 20-150 | | 76 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 67 | 20-150 | | 82 | 20-150 | H | 81 | 20-150 |
| 13C5-PFHxA | | 73 | 20-150 | | 77 | 20-150 | H | 83 | 20-150 |
| 13C5-PFPeA | | 73 | 20-150 | | 75 | 20-150 | H | 84 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 | | 74 | 20-150 | H | 70 | 20-150 |
| 13C7-PFUnA | | 68 | 20-150 | | 63 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOA | | 81 | 20-150 | | 58 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOS | | 70 | 20-150 | | 77 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOSA | | 135 | 20-150 | | 93 | 20-150 | H | 81 | 20-150 |
| 13C9-PFNA | | 72 | 20-150 | M-03 | 73 | 20-150 | H | 80 | 20-150 |
| D3-NMeFOSA | | 104 | 20-150 | | 75 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 128 | 20-150 | | 95 | 20-150 | H | 79 | 20-150 |
| D5-NEtFOSA | | 95 | 20-150 | | 66 | 20-150 | H | 56 | 20-150 |
| D5-NEtFOSAA | | 106 | 20-150 | | 83 | 20-150 | H | 103 | 20-150 |
| D7-NMeFOSE | | 65 | 20-150 | | 45 | 20-150 | H | 75 | 20-150 |
| D9-NEtFOSE | | 45 | 20-150 | | 32 | 20-150 | H | 73 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-006
Description: VRTB-L-06_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 0923 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1723 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1554 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1940 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 88 | HJM-03 | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 540 | H | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 16 | HJ | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 84 | HJ | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 84 | HM-03 | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 180 | H | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1900 | HM-03 | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 220 | H | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 90 | HM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 17000 | HM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 250 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 65 | HM-03 | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 170 | H | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-006
Description: VRTB-L-06_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 0923
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 96 | 20-150 | | 80 | 20-150 | H | 67 | 20-150 |
| 13C2-6:2FTS | | 92 | 20-150 | | 75 | 20-150 | H | 69 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | | 86 | 20-150 | H | 68 | 20-150 |
| 13C2-PFDoA | | 63 | 20-150 | | 62 | 20-150 | H | 80 | 20-150 |
| 13C2-PFTeDA | | 44 | 20-150 | | 44 | 20-150 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 76 | 20-150 | | 74 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 | | 82 | 20-150 | H | 73 | 20-150 |
| 13C3-PFHxS | | 71 | 20-150 | | 73 | 20-150 | H | 71 | 20-150 |
| 13C4-PFBA | | 76 | 20-150 | | 76 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 67 | 20-150 | | 82 | 20-150 | H | 81 | 20-150 |
| 13C5-PFHxA | | 73 | 20-150 | | 77 | 20-150 | H | 83 | 20-150 |
| 13C5-PFPeA | | 73 | 20-150 | | 75 | 20-150 | H | 84 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 | | 74 | 20-150 | H | 70 | 20-150 |
| 13C7-PFUnA | | 68 | 20-150 | | 63 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOA | | 81 | 20-150 | | 58 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOS | | 70 | 20-150 | | 77 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOSA | | 135 | 20-150 | | 93 | 20-150 | H | 81 | 20-150 |
| 13C9-PFNA | | 72 | 20-150 | M-03 | 73 | 20-150 | H | 80 | 20-150 |
| D3-NMeFOSA | | 104 | 20-150 | | 75 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 128 | 20-150 | | 95 | 20-150 | H | 79 | 20-150 |
| D5-NEtFOSA | | 95 | 20-150 | | 66 | 20-150 | H | 56 | 20-150 |
| D5-NEtFOSAA | | 106 | 20-150 | | 83 | 20-150 | H | 103 | 20-150 |
| D7-NMeFOSE | | 65 | 20-150 | | 45 | 20-150 | H | 75 | 20-150 |
| D9-NEtFOSE | | 45 | 20-150 | | 32 | 20-150 | H | 73 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-007
Description: VRTB-L-P7_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 1252 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1732 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1603 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1949 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 44 | M-03 | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 82 | | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 13 | | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 53 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 150 | | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 120 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1200 | EM-03 | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 140 | | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 67 | M-03 | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.9 | QM-03 | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 17000 | EM-03 | 0.96 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 180 | M-03 | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 35 | | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 110 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | J | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-007
Description: VRTB-L-P7_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 1252 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 91 | 20-150 | | 94 | 20-150 | H | 68 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 | | 86 | 20-150 | H | 64 | 20-150 |
| 13C2-8:2FTS | | 78 | 20-150 | | 81 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | | 62 | 20-150 | | 57 | 20-150 | H | 73 | 20-150 |
| 13C2-PFTeDA | | 23 | 20-150 | M-03 | 21 | 20-150 | H | 68 | 20-150 |
| 13C3-HFPO-DA | | 78 | 20-150 | M-03 | 81 | 20-150 | H | 77 | 20-150 |
| 13C3-PFBS | | 90 | 20-150 | | 80 | 20-150 | H | 69 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 | | 75 | 20-150 | H | 66 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 | | 80 | 20-150 | H | 74 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 | | 78 | 20-150 | H | 74 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 | | 81 | 20-150 | H | 71 | 20-150 |
| 13C5-PFPeA | | 78 | 20-150 | | 79 | 20-150 | H | 76 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | | 73 | 20-150 | H | 72 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 | | 72 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOA | | 86 | 20-150 | | 88 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOS | | 77 | 20-150 | | 76 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOSA | N | 155 | 20-150 | | 91 | 20-150 | H | 74 | 20-150 |
| 13C9-PFNA | | 81 | 20-150 | | 79 | 20-150 | H | 75 | 20-150 |
| D3-NMeFOSA | | 104 | 20-150 | | 61 | 20-150 | H | 54 | 20-150 |
| D3-NMeFOSAA | | 137 | 20-150 | | 92 | 20-150 | H | 74 | 20-150 |
| D5-NEtFOSA | | 77 | 20-150 | M-03 | 47 | 20-150 | H | 54 | 20-150 |
| D5-NEtFOSAA | | 108 | 20-150 | M-03 | 78 | 20-150 | H | 75 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 | | 41 | 20-150 | H | 70 | 20-150 |
| D9-NEtFOSE | | 38 | 20-150 | | 24 | 20-150 | H | 67 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-007
Description: VRTB-L-P7_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 1252
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1732 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1603 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1949 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.2 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.2 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.2 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 42 | M-03 | 19 | 7.1 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 73 | M-03 | 24 | 22 | 9.7 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.7 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.62 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.6 | U | 48 | 9.6 | 2.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.6 | U | 48 | 9.6 | 3.0 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.2 | U | 9.6 | 6.2 | 2.8 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.3 | U | 9.6 | 5.3 | 1.7 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.1 | U | 9.6 | 3.1 | 0.88 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.2 | U | 9.6 | 6.2 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 13 | | 4.8 | 1.7 | 0.45 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 52 | | 19 | 7.6 | 2.4 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.79 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.65 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.74 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.51 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 97 | | 4.8 | 1.8 | 0.91 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 120 | | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1200 | M-03 | 4.8 | 3.5 | 0.88 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 150 | | 4.8 | 1.9 | 0.68 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.8 | U | 4.8 | 1.8 | 0.70 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 58 | | 4.8 | 1.9 | 0.49 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.3 | JM-03 | 4.8 | 1.9 | 0.95 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 16000 | EM-03 | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 190 | M-03 | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 32 | | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 110 | | 9.6 | 1.9 | 0.88 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.8 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.93 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-007
Description: VRTB-L-P7_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 1252
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 91 | 20-150 | | 94 | 20-150 | H | 68 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 | | 86 | 20-150 | H | 64 | 20-150 |
| 13C2-8:2FTS | | 78 | 20-150 | | 81 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | | 62 | 20-150 | | 57 | 20-150 | H | 73 | 20-150 |
| 13C2-PFTeDA | | 23 | 20-150 | M-03 | 21 | 20-150 | H | 68 | 20-150 |
| 13C3-HFPO-DA | | 78 | 20-150 | M-03 | 81 | 20-150 | H | 77 | 20-150 |
| 13C3-PFBS | | 90 | 20-150 | | 80 | 20-150 | H | 69 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 | | 75 | 20-150 | H | 66 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 | | 80 | 20-150 | H | 74 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 | | 78 | 20-150 | H | 74 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 | | 81 | 20-150 | H | 71 | 20-150 |
| 13C5-PFPeA | | 78 | 20-150 | | 79 | 20-150 | H | 76 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | | 73 | 20-150 | H | 72 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 | | 72 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOA | | 86 | 20-150 | | 88 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOS | | 77 | 20-150 | | 76 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOSA | N | 155 | 20-150 | | 91 | 20-150 | H | 74 | 20-150 |
| 13C9-PFNA | | 81 | 20-150 | | 79 | 20-150 | H | 75 | 20-150 |
| D3-NMeFOSA | | 104 | 20-150 | | 61 | 20-150 | H | 54 | 20-150 |
| D3-NMeFOSAA | | 137 | 20-150 | | 92 | 20-150 | H | 74 | 20-150 |
| D5-NEtFOSA | | 77 | 20-150 | M-03 | 47 | 20-150 | H | 54 | 20-150 |
| D5-NEtFOSAA | | 108 | 20-150 | M-03 | 78 | 20-150 | H | 75 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 | | 41 | 20-150 | H | 70 | 20-150 |
| D9-NEtFOSE | | 38 | 20-150 | | 24 | 20-150 | H | 67 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-007
Description: VRTB-L-P7_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 1252 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/13/2023 1732 | ALM | 11/16/2023 1218 | 90185 |
| 2 | 1633 | 1633 | 5 | 12/14/2023 1603 | ALM | 11/16/2023 1218 | 90185 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1949 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 44 | HJM-03 | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 120 | HJ | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 16 | HJ | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 70 | HJ | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 80 | HM-03 | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 140 | H | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1400 | HM-03 | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 180 | H | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 80 | HM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 17000 | HM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 230 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 41 | HJ | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 150 | HM-03 | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-007
Description: VRTB-L-P7_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 1252
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 91 | 20-150 | | 94 | 20-150 | H | 68 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 | | 86 | 20-150 | H | 64 | 20-150 |
| 13C2-8:2FTS | | 78 | 20-150 | | 81 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | | 62 | 20-150 | | 57 | 20-150 | H | 73 | 20-150 |
| 13C2-PFTeDA | | 23 | 20-150 | M-03 | 21 | 20-150 | H | 68 | 20-150 |
| 13C3-HFPO-DA | | 78 | 20-150 | M-03 | 81 | 20-150 | H | 77 | 20-150 |
| 13C3-PFBS | | 90 | 20-150 | | 80 | 20-150 | H | 69 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 | | 75 | 20-150 | H | 66 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 | | 80 | 20-150 | H | 74 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 | | 78 | 20-150 | H | 74 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 | | 81 | 20-150 | H | 71 | 20-150 |
| 13C5-PFPeA | | 78 | 20-150 | | 79 | 20-150 | H | 76 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | | 73 | 20-150 | H | 72 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 | | 72 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOA | | 86 | 20-150 | | 88 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOS | | 77 | 20-150 | | 76 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOSA | N | 155 | 20-150 | | 91 | 20-150 | H | 74 | 20-150 |
| 13C9-PFNA | | 81 | 20-150 | | 79 | 20-150 | H | 75 | 20-150 |
| D3-NMeFOSA | | 104 | 20-150 | | 61 | 20-150 | H | 54 | 20-150 |
| D3-NMeFOSAA | | 137 | 20-150 | | 92 | 20-150 | H | 74 | 20-150 |
| D5-NEtFOSA | | 77 | 20-150 | M-03 | 47 | 20-150 | H | 54 | 20-150 |
| D5-NEtFOSAA | | 108 | 20-150 | M-03 | 78 | 20-150 | H | 75 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 | | 41 | 20-150 | H | 70 | 20-150 |
| D9-NEtFOSE | | 38 | 20-150 | | 24 | 20-150 | H | 67 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-008
Description: VRTB-L-BB8_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 1343 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1811 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1345 | ALM | 11/20/2023 1710 | 90470 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1958 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.86 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.66 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.65 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 25 | M-03 | 3.9 | 1.5 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 43 | | 4.9 | 4.5 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.98 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 9.8 | 2.0 | 0.60 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 9.8 | 2.0 | 0.62 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.57 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 2.8 | | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 31 | | 0.98 | 0.34 | 0.092 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 52 | | 3.9 | 1.6 | 0.50 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | U | 0.98 | 0.38 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | JM-03 | 0.98 | 0.39 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | U | 0.98 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 170 | M-03 | 0.98 | 0.37 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 94 | | 0.98 | 0.78 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1500 | EM-03 | 0.98 | 0.72 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 210 | | 0.98 | 0.39 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.44 | JM-03 | 0.98 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 55 | M-03 | 0.98 | 0.39 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.5 | M-03 | 0.98 | 0.39 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 15000 | EM-03 | 0.98 | 0.73 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 150 | M-03 | 0.98 | 0.78 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 89 | | 0.98 | 0.74 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 99 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 0.91 | J | 4.9 | 2.0 | 0.59 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-008
Description: VRTB-L-BB8_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 1343
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 97 | 20-150 | | 94 | 20-150 | H | 60 | 20-150 |
| 13C2-6:2FTS | | 90 | 20-150 | | 78 | 20-150 | H | 61 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | M-03 | 73 | 20-150 | H | 59 | 20-150 |
| 13C2-PFDoA | | 48 | 20-150 | | 56 | 20-150 | H | 61 | 20-150 |
| 13C2-PFTeDA | | 34 | 20-150 | | 46 | 20-150 | H | 58 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 | | 75 | 20-150 | H | 65 | 20-150 |
| 13C3-PFBS | | 98 | 20-150 | M-03 | 82 | 20-150 | H | 64 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 | | 79 | 20-150 | H | 60 | 20-150 |
| 13C4-PFBA | | 77 | 20-150 | | 78 | 20-150 | H | 65 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 | | 78 | 20-150 | H | 69 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 | | 75 | 20-150 | H | 65 | 20-150 |
| 13C5-PFPeA | | 77 | 20-150 | | 76 | 20-150 | H | 69 | 20-150 |
| 13C6-PFDA | | 68 | 20-150 | | 87 | 20-150 | H | 60 | 20-150 |
| 13C7-PFUnA | | 52 | 20-150 | | 69 | 20-150 | H | 58 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 | | 89 | 20-150 | H | 64 | 20-150 |
| 13C8-PFOS | | 68 | 20-150 | M-03 | 78 | 20-150 | H | 66 | 20-150 |
| 13C8-PFOSA | | 124 | 20-150 | | 88 | 20-150 | H | 68 | 20-150 |
| 13C9-PFNA | | 75 | 20-150 | M-03 | 76 | 20-150 | H | 64 | 20-150 |
| D3-NMeFOSA | | 94 | 20-150 | | 74 | 20-150 | H | 47 | 20-150 |
| D3-NMeFOSAA | | 113 | 20-150 | | 91 | 20-150 | H | 69 | 20-150 |
| D5-NEtFOSA | | 87 | 20-150 | | 66 | 20-150 | H | 46 | 20-150 |
| D5-NEtFOSAA | | 82 | 20-150 | M-03 | 64 | 20-150 | H | 68 | 20-150 |
| D7-NMeFOSE | | 84 | 20-150 | | 65 | 20-150 | H | 60 | 20-150 |
| D9-NEtFOSE | | 42 | 20-150 | | 33 | 20-150 | H | 58 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-008

Description: VRTB-L-BB8_10242023 | Matrix: Aqueous

Date Sampled: 10/24/2023 1343 | Project Name: Grayling GWS

Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1811 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1345 | ALM | 11/20/2023 1710 | 90470 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1958 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.3 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.3 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 24 | M-03 | 20 | 7.5 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 43 | M-03 | 25 | 23 | 9.9 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 4.9 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.63 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.8 | U | 49 | 9.8 | 3.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.8 | U | 49 | 9.8 | 3.1 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.4 | U | 9.8 | 6.4 | 2.8 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.4 | U | 9.8 | 5.4 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 2.6 | J | 9.8 | 3.1 | 0.91 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.4 | U | 9.8 | 6.4 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 33 | | 4.9 | 1.7 | 0.46 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 49 | | 20 | 8.0 | 2.5 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.81 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.66 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.76 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.52 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 90 | | 4.9 | 1.9 | 0.93 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 91 | | 4.9 | 3.9 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1500 | M-03 | 4.9 | 3.6 | 0.91 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 230 | | 4.9 | 2.0 | 0.70 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | UM-03 | 4.9 | 1.9 | 0.72 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 48 | | 4.9 | 2.0 | 0.51 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.98 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 13000 | EM-03 | 4.9 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 160 | M-03 | 4.9 | 3.9 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 78 | | 4.9 | 3.7 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 100 | | 9.8 | 2.0 | 0.91 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | U | 25 | 10 | 2.9 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.95 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-008
Description: VRTB-L-BB8_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 1343
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 97 | 20-150 | | 94 | 20-150 | H | 60 | 20-150 |
| 13C2-6:2FTS | | 90 | 20-150 | | 78 | 20-150 | H | 61 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | M-03 | 73 | 20-150 | H | 59 | 20-150 |
| 13C2-PFDoA | | 48 | 20-150 | | 56 | 20-150 | H | 61 | 20-150 |
| 13C2-PFTeDA | | 34 | 20-150 | | 46 | 20-150 | H | 58 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 | | 75 | 20-150 | H | 65 | 20-150 |
| 13C3-PFBS | | 98 | 20-150 | M-03 | 82 | 20-150 | H | 64 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 | | 79 | 20-150 | H | 60 | 20-150 |
| 13C4-PFBA | | 77 | 20-150 | | 78 | 20-150 | H | 65 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 | | 78 | 20-150 | H | 69 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 | | 75 | 20-150 | H | 65 | 20-150 |
| 13C5-PFPeA | | 77 | 20-150 | | 76 | 20-150 | H | 69 | 20-150 |
| 13C6-PFDA | | 68 | 20-150 | | 87 | 20-150 | H | 60 | 20-150 |
| 13C7-PFUnA | | 52 | 20-150 | | 69 | 20-150 | H | 58 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 | | 89 | 20-150 | H | 64 | 20-150 |
| 13C8-PFOS | | 68 | 20-150 | M-03 | 78 | 20-150 | H | 66 | 20-150 |
| 13C8-PFOSA | | 124 | 20-150 | | 88 | 20-150 | H | 68 | 20-150 |
| 13C9-PFNA | | 75 | 20-150 | M-03 | 76 | 20-150 | H | 64 | 20-150 |
| D3-NMeFOSA | | 94 | 20-150 | | 74 | 20-150 | H | 47 | 20-150 |
| D3-NMeFOSAA | | 113 | 20-150 | | 91 | 20-150 | H | 69 | 20-150 |
| D5-NEtFOSA | | 87 | 20-150 | | 66 | 20-150 | H | 46 | 20-150 |
| D5-NEtFOSAA | | 82 | 20-150 | M-03 | 64 | 20-150 | H | 68 | 20-150 |
| D7-NMeFOSE | | 84 | 20-150 | | 65 | 20-150 | H | 60 | 20-150 |
| D9-NEtFOSE | | 42 | 20-150 | | 33 | 20-150 | H | 58 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-008
Description: VRTB-L-BB8_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 1343 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1811 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1345 | ALM | 11/20/2023 1710 | 90470 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 1958 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 75 | UH | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 230 | UH | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 41 | HJ | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 62 | HJ | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 66 | H | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 110 | HM-03 | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1800 | H | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 270 | H | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 75 | HM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 13000 | HM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 200 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 100 | H | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 120 | H | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-008
Description: VRTB-L-BB8_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 1343
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 97 | 20-150 | | 94 | 20-150 | H | 60 | 20-150 |
| 13C2-6:2FTS | | 90 | 20-150 | | 78 | 20-150 | H | 61 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | M-03 | 73 | 20-150 | H | 59 | 20-150 |
| 13C2-PFDoA | | 48 | 20-150 | | 56 | 20-150 | H | 61 | 20-150 |
| 13C2-PFTeDA | | 34 | 20-150 | | 46 | 20-150 | H | 58 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 | | 75 | 20-150 | H | 65 | 20-150 |
| 13C3-PFBS | | 98 | 20-150 | M-03 | 82 | 20-150 | H | 64 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 | | 79 | 20-150 | H | 60 | 20-150 |
| 13C4-PFBA | | 77 | 20-150 | | 78 | 20-150 | H | 65 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 | | 78 | 20-150 | H | 69 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 | | 75 | 20-150 | H | 65 | 20-150 |
| 13C5-PFPeA | | 77 | 20-150 | | 76 | 20-150 | H | 69 | 20-150 |
| 13C6-PFDA | | 68 | 20-150 | | 87 | 20-150 | H | 60 | 20-150 |
| 13C7-PFUnA | | 52 | 20-150 | | 69 | 20-150 | H | 58 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 | | 89 | 20-150 | H | 64 | 20-150 |
| 13C8-PFOS | | 68 | 20-150 | M-03 | 78 | 20-150 | H | 66 | 20-150 |
| 13C8-PFOSA | | 124 | 20-150 | | 88 | 20-150 | H | 68 | 20-150 |
| 13C9-PFNA | | 75 | 20-150 | M-03 | 76 | 20-150 | H | 64 | 20-150 |
| D3-NMeFOSA | | 94 | 20-150 | | 74 | 20-150 | H | 47 | 20-150 |
| D3-NMeFOSAA | | 113 | 20-150 | | 91 | 20-150 | H | 69 | 20-150 |
| D5-NEtFOSA | | 87 | 20-150 | | 66 | 20-150 | H | 46 | 20-150 |
| D5-NEtFOSAA | | 82 | 20-150 | M-03 | 64 | 20-150 | H | 68 | 20-150 |
| D7-NMeFOSE | | 84 | 20-150 | | 65 | 20-150 | H | 60 | 20-150 |
| D9-NEtFOSE | | 42 | 20-150 | | 33 | 20-150 | H | 58 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-009
Description: VRTB-S-B1_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 1516 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1820 | ALM | 11/20/2023 1710 | 90470 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.77 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.53 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.87 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.55 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 3.0 | | 0.88 | 0.31 | 0.082 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 5.5 | M-03 | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.094 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.2 | | 0.88 | 0.33 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 2.8 | | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 30 | M-03 | 0.88 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 7.9 | | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.33 | U | 0.88 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.37 | JM-03 | 0.88 | 0.35 | 0.090 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 180 | M-03 | 0.88 | 0.65 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 2.5 | M-03 | 0.88 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 1.8 | | 0.88 | 0.66 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 8.0 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.52 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-009
Description: VRTB-S-B1_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 1516
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 88 | 20-150 |
| 13C2-6:2FTS | | 86 | 20-150 |
| 13C2-8:2FTS | | 71 | 20-150 |
| 13C2-PFDoA | | 65 | 20-150 |
| 13C2-PFTeDA | | 50 | 20-150 |
| 13C3-HFPO-DA | | 84 | 20-150 |
| 13C3-PFBS | | 80 | 20-150 |
| 13C3-PFHxS | | 79 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 |
| 13C5-PFHxA | | 86 | 20-150 |
| 13C5-PFPeA | | 81 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 |
| 13C8-PFOS | | 73 | 20-150 |
| 13C8-PFOSA | | 67 | 20-150 |
| 13C9-PFNA | | 80 | 20-150 |
| D3-NMeFOSA | | 58 | 20-150 |
| D3-NMeFOSAA | | 77 | 20-150 |
| D5-NEtFOSA | | 54 | 20-150 |
| D5-NEtFOSAA | | 68 | 20-150 |
| D7-NMeFOSE | | 61 | 20-150 |
| D9-NEtFOSE | | 50 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-010
Description: VRTB-S-S2_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 1706 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1829 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1354 | ALM | 11/20/2023 1710 | 90470 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.85 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.65 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.65 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 0.61 | J | 3.9 | 1.5 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 2.4 | JM-03 | 4.9 | 4.5 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.97 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 9.8 | 2.0 | 0.60 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 9.8 | 2.0 | 0.62 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.56 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 4.7 | | 0.98 | 0.34 | 0.092 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 16 | | 3.9 | 1.6 | 0.50 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | U | 0.98 | 0.38 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | U | 0.98 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 11 | | 0.98 | 0.37 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 29 | | 0.98 | 0.78 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 150 | M-03 | 0.98 | 0.72 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 27 | | 0.98 | 0.39 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.44 | JM-03 | 0.98 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 21 | M-03 | 0.98 | 0.39 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.1 | M-03 | 0.98 | 0.39 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 770 | M-03 | 4.9 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 46 | M-03 | 0.98 | 0.78 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 7.4 | | 0.98 | 0.74 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 25 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.58 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-010
Description: VRTB-S-S2_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 1706
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 95 | 20-150 | M-03 | 80 | 20-150 |
| 13C2-6:2FTS | | 85 | 20-150 | | 83 | 20-150 |
| 13C2-8:2FTS | M-03 | 80 | 20-150 | | 71 | 20-150 |
| 13C2-PFDoA | | 58 | 20-150 | | 58 | 20-150 |
| 13C2-PFTeDA | | 43 | 20-150 | | 37 | 20-150 |
| 13C3-HFPO-DA | | 84 | 20-150 | | 84 | 20-150 |
| 13C3-PFBS | | 84 | 20-150 | | 78 | 20-150 |
| 13C3-PFHxS | | 81 | 20-150 | | 78 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 | | 86 | 20-150 |
| 13C4-PFHpA | | 80 | 20-150 | | 85 | 20-150 |
| 13C5-PFHxA | | 82 | 20-150 | | 87 | 20-150 |
| 13C5-PFPeA | | 81 | 20-150 | | 84 | 20-150 |
| 13C6-PFDA | | 82 | 20-150 | | 80 | 20-150 |
| 13C7-PFUnA | | 71 | 20-150 | | 70 | 20-150 |
| 13C8-PFOA | | 87 | 20-150 | | 85 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 | | 82 | 20-150 |
| 13C8-PFOSA | | 78 | 20-150 | | 74 | 20-150 |
| 13C9-PFNA | | 75 | 20-150 | M-03 | 77 | 20-150 |
| D3-NMeFOSA | | 61 | 20-150 | | 58 | 20-150 |
| D3-NMeFOSAA | | 76 | 20-150 | | 69 | 20-150 |
| D5-NEtFOSA | | 59 | 20-150 | | 54 | 20-150 |
| D5-NEtFOSAA | | 67 | 20-150 | M-03 | 60 | 20-150 |
| D7-NMeFOSE | | 58 | 20-150 | | 55 | 20-150 |
| D9-NEtFOSE | | 37 | 20-150 | | 35 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-011
Description: VRTB-S-Y3_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 1800 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1838 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1403 | ALM | 11/20/2023 1710 | 90470 |
| 3 | 1633 | 1633 | 5 | 01/11/2024 0611 | ALM | 12/21/2023 1102 | 92830 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 3.1 | U | 5.4 | 3.1 | 1.2 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 3.0 | U | 5.4 | 3.0 | 0.91 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 3.1 | U | 5.4 | 3.1 | 0.90 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 2.7 | JM-03 | 5.4 | 2.0 | 0.83 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 2.0 | U | 5.4 | 2.0 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 6.3 | U | 6.8 | 6.3 | 2.7 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 14 | U | 34 | 14 | 5.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 3.2 | U | 5.4 | 3.2 | 1.3 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.56 | U | 1.4 | 0.56 | 0.17 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 1.1 | U | 1.4 | 1.1 | 0.40 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.8 | U | 14 | 2.8 | 0.83 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 1.1 | U | 1.4 | 1.1 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 1.1 | U | 1.4 | 1.1 | 0.40 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.8 | U | 14 | 2.8 | 0.86 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.8 | U | 2.7 | 1.8 | 0.78 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.5 | U | 2.7 | 1.5 | 0.49 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.86 | U | 2.7 | 0.86 | 0.25 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.8 | U | 2.7 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 7.6 | | 1.4 | 0.49 | 0.13 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 13 | | 5.4 | 2.2 | 0.69 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.55 | U | 1.4 | 0.55 | 0.22 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.56 | U | 1.4 | 0.56 | 0.18 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.55 | U | 1.4 | 0.55 | 0.21 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.56 | U | 1.4 | 0.56 | 0.14 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 36 | | 1.4 | 0.53 | 0.26 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 14 | | 1.4 | 1.1 | 0.29 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 14 | U | 34 | 14 | 5.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 570 | M-03 | 1.4 | 1.0 | 0.25 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 32 | | 1.4 | 0.56 | 0.19 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.42 | JM-03 | 1.4 | 0.53 | 0.20 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 5.9 | M-03 | 1.4 | 0.56 | 0.14 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.2 | M-03 | 1.4 | 0.56 | 0.27 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1700 | EM-03 | 1.4 | 1.0 | 0.34 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 25 | M-03 | 1.4 | 1.1 | 0.28 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 17 | | 1.4 | 1.1 | 0.35 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 21 | | 2.7 | 0.54 | 0.25 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.7 | U | 6.8 | 2.7 | 0.81 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 1.1 | UQ | 1.4 | 1.1 | 0.36 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.56 | U | 1.4 | 0.56 | 0.26 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 1.1 | U | 1.4 | 1.1 | 0.34 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-011
Description: VRTB-S-Y3_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 1800
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 68 | 20-150 | M-03 | 59 | 20-150 | H | 85 | 20-150 |
| 13C2-6:2FTS | | 59 | 20-150 | M-03 | 51 | 20-150 | HM-03 | 73 | 20-150 |
| 13C2-8:2FTS | | 60 | 20-150 | M-03 | 53 | 20-150 | HM-03 | 65 | 20-150 |
| 13C2-PFDoA | | 40 | 20-150 | | 40 | 20-150 | HM-03 | 38 | 20-150 |
| 13C2-PFTeDA | N | 17 | 20-150 | N | 19 | 20-150 | HN | 14 | 20-150 |
| 13C3-HFPO-DA | | 61 | 20-150 | | 54 | 20-150 | H | 65 | 20-150 |
| 13C3-PFBS | | 60 | 20-150 | | 59 | 20-150 | H | 79 | 20-150 |
| 13C3-PFHxS | | 54 | 20-150 | | 62 | 20-150 | H | 84 | 20-150 |
| 13C4-PFBA | | 55 | 20-150 | | 55 | 20-150 | H | 70 | 20-150 |
| 13C4-PFHpA | | 58 | 20-150 | | 52 | 20-150 | H | 64 | 20-150 |
| 13C5-PFHxA | | 54 | 20-150 | | 53 | 20-150 | H | 71 | 20-150 |
| 13C5-PFPeA | | 57 | 20-150 | | 52 | 20-150 | H | 63 | 20-150 |
| 13C6-PFDA | | 60 | 20-150 | | 63 | 20-150 | HM-03 | 53 | 20-150 |
| 13C7-PFUnA | | 55 | 20-150 | | 53 | 20-150 | H | 52 | 20-150 |
| 13C8-PFOA | | 52 | 20-150 | M-03 | 48 | 20-150 | HM-03 | 70 | 20-150 |
| 13C8-PFOS | | 54 | 20-150 | | 56 | 20-150 | H | 57 | 20-150 |
| 13C8-PFOSA | | 56 | 20-150 | | 52 | 20-150 | H | 55 | 20-150 |
| 13C9-PFNA | | 56 | 20-150 | M-03 | 56 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 34 | 20-150 | M-03 | 33 | 20-150 | H | 39 | 20-150 |
| D3-NMeFOSAA | | 61 | 20-150 | | 61 | 20-150 | H | 45 | 20-150 |
| D5-NEtFOSA | | 29 | 20-150 | | 26 | 20-150 | H | 34 | 20-150 |
| D5-NEtFOSAA | | 52 | 20-150 | | 48 | 20-150 | HM-03 | 40 | 20-150 |
| D7-NMeFOSE | | 38 | 20-150 | | 36 | 20-150 | H | 48 | 20-150 |
| D9-NEtFOSE | | 31 | 20-150 | | 29 | 20-150 | H | 39 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-011
Description: VRTB-S-Y3_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 1800 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1838 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1403 | ALM | 11/20/2023 1710 | 90470 |
| 3 | 1633 | 1633 | 5 | 01/11/2024 0611 | ALM | 12/21/2023 1102 | 92830 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 16 | U | 27 | 16 | 5.9 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 15 | U | 27 | 15 | 4.5 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 16 | U | 27 | 16 | 4.5 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 10 | U | 27 | 10 | 4.1 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 10 | U | 27 | 10 | 2.7 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 31 | U | 34 | 31 | 14 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 68 | U | 170 | 68 | 29 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 16 | U | 27 | 16 | 6.7 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.7 | U | 6.8 | 2.7 | 0.87 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 5.4 | U | 6.8 | 5.4 | 2.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 14 | U | 68 | 14 | 4.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 5.4 | U | 6.8 | 5.4 | 1.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 5.4 | U | 6.8 | 5.4 | 2.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 14 | U | 68 | 14 | 4.3 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 9.1 | U | 14 | 9.1 | 3.9 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 7.7 | U | 14 | 7.7 | 2.5 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 4.5 | U | 14 | 4.5 | 1.3 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 9.1 | U | 14 | 9.1 | 2.6 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 7.8 | M-03 | 6.8 | 2.4 | 0.64 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 13 | JM-03 | 27 | 11 | 3.5 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.7 | U | 6.8 | 2.7 | 1.1 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.7 | U | 6.8 | 2.7 | 0.92 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.7 | U | 6.8 | 2.7 | 1.0 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.7 | U | 6.8 | 2.7 | 0.72 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 30 | | 6.8 | 2.6 | 1.3 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 13 | M-03 | 6.8 | 5.4 | 1.4 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 68 | U | 170 | 68 | 28 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 500 | M-03 | 6.8 | 5.0 | 1.3 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 33 | | 6.8 | 2.7 | 0.96 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 2.6 | UM-03 | 6.8 | 2.6 | 0.99 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 5.5 | JM-03 | 6.8 | 2.7 | 0.70 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.2 | JM-03 | 6.8 | 2.7 | 1.3 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1600 | M-03 | 6.8 | 5.0 | 1.7 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 27 | | 6.8 | 5.4 | 1.4 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 15 | M-03 | 6.8 | 5.1 | 1.7 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 22 | M-03 | 14 | 2.8 | 1.3 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 14 | U | 34 | 14 | 4.0 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 5.4 | UQ | 6.8 | 5.4 | 1.8 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.7 | U | 6.8 | 2.7 | 1.3 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 5.4 | U | 6.8 | 5.4 | 1.7 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-011
Description: VRTB-S-Y3_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 1800
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 68 | 20-150 | M-03 | 59 | 20-150 | H | 85 | 20-150 |
| 13C2-6:2FTS | | 59 | 20-150 | M-03 | 51 | 20-150 | HM-03 | 73 | 20-150 |
| 13C2-8:2FTS | | 60 | 20-150 | M-03 | 53 | 20-150 | HM-03 | 65 | 20-150 |
| 13C2-PFDoA | | 40 | 20-150 | | 40 | 20-150 | HM-03 | 38 | 20-150 |
| 13C2-PFTeDA | N | 17 | 20-150 | N | 19 | 20-150 | HN | 14 | 20-150 |
| 13C3-HFPO-DA | | 61 | 20-150 | | 54 | 20-150 | H | 65 | 20-150 |
| 13C3-PFBS | | 60 | 20-150 | | 59 | 20-150 | H | 79 | 20-150 |
| 13C3-PFHxS | | 54 | 20-150 | | 62 | 20-150 | H | 84 | 20-150 |
| 13C4-PFBA | | 55 | 20-150 | | 55 | 20-150 | H | 70 | 20-150 |
| 13C4-PFHpA | | 58 | 20-150 | | 52 | 20-150 | H | 64 | 20-150 |
| 13C5-PFHxA | | 54 | 20-150 | | 53 | 20-150 | H | 71 | 20-150 |
| 13C5-PFPeA | | 57 | 20-150 | | 52 | 20-150 | H | 63 | 20-150 |
| 13C6-PFDA | | 60 | 20-150 | | 63 | 20-150 | HM-03 | 53 | 20-150 |
| 13C7-PFUnA | | 55 | 20-150 | | 53 | 20-150 | H | 52 | 20-150 |
| 13C8-PFOA | | 52 | 20-150 | M-03 | 48 | 20-150 | HM-03 | 70 | 20-150 |
| 13C8-PFOS | | 54 | 20-150 | | 56 | 20-150 | H | 57 | 20-150 |
| 13C8-PFOSA | | 56 | 20-150 | | 52 | 20-150 | H | 55 | 20-150 |
| 13C9-PFNA | | 56 | 20-150 | M-03 | 56 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 34 | 20-150 | M-03 | 33 | 20-150 | H | 39 | 20-150 |
| D3-NMeFOSAA | | 61 | 20-150 | | 61 | 20-150 | H | 45 | 20-150 |
| D5-NEtFOSA | | 29 | 20-150 | | 26 | 20-150 | H | 34 | 20-150 |
| D5-NEtFOSAA | | 52 | 20-150 | | 48 | 20-150 | HM-03 | 40 | 20-150 |
| D7-NMeFOSE | | 38 | 20-150 | | 36 | 20-150 | H | 48 | 20-150 |
| D9-NEtFOSE | | 31 | 20-150 | | 29 | 20-150 | H | 39 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-011
Description: VRTB-S-Y3_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 1800 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1838 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1403 | ALM | 11/20/2023 1710 | 90470 |
| 3 | 1633 | 1633 | 5 | 01/11/2024 0611 | ALM | 12/21/2023 1102 | 92830 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | UH | 20 | 12 | 4.4 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | UH | 20 | 11 | 3.4 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | UH | 20 | 12 | 3.3 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | UH | 20 | 7.5 | 3.1 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | UH | 20 | 7.5 | 2.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | UH | 25 | 23 | 10 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | UH | 130 | 52 | 22 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | UH | 20 | 12 | 5.0 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.65 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.5 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | UH | 50 | 10 | 3.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.5 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | UH | 50 | 10 | 3.2 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | UH | 10 | 6.5 | 2.9 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | UH | 10 | 5.5 | 1.8 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | UH | 10 | 3.2 | 0.93 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | UH | 10 | 6.5 | 2.0 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.5 | H | 5.0 | 1.8 | 0.47 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 12 | HJ | 20 | 8.0 | 2.6 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.83 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.68 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.78 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.54 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 33 | H | 5.0 | 1.9 | 0.96 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 13 | HM-03 | 5.0 | 4.0 | 1.1 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | UH | 130 | 52 | 21 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 460 | HM-03 | 5.0 | 3.7 | 0.93 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 30 | H | 5.0 | 2.0 | 0.72 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | UH | 5.0 | 1.9 | 0.73 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 5.7 | HM-03 | 5.0 | 2.0 | 0.52 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | UH | 5.0 | 2.0 | 1.0 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1800 | HM-03 | 5.0 | 3.7 | 1.2 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 22 | HM-03 | 5.0 | 4.0 | 1.1 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 14 | HM-03 | 5.0 | 3.8 | 1.3 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 22 | H | 10 | 2.0 | 0.93 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | UH | 25 | 10 | 3.0 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | UHQ | 5.0 | 4.0 | 1.4 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.98 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.2 | ng/L | 3 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-011
Description: VRTB-S-Y3_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023 1800
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 68 | 20-150 | M-03 | 59 | 20-150 | H | 85 | 20-150 |
| 13C2-6:2FTS | | 59 | 20-150 | M-03 | 51 | 20-150 | HM-03 | 73 | 20-150 |
| 13C2-8:2FTS | | 60 | 20-150 | M-03 | 53 | 20-150 | HM-03 | 65 | 20-150 |
| 13C2-PFDoA | | 40 | 20-150 | | 40 | 20-150 | HM-03 | 38 | 20-150 |
| 13C2-PFTeDA | N | 17 | 20-150 | N | 19 | 20-150 | HN | 14 | 20-150 |
| 13C3-HFPO-DA | | 61 | 20-150 | | 54 | 20-150 | H | 65 | 20-150 |
| 13C3-PFBS | | 60 | 20-150 | | 59 | 20-150 | H | 79 | 20-150 |
| 13C3-PFHxS | | 54 | 20-150 | | 62 | 20-150 | H | 84 | 20-150 |
| 13C4-PFBA | | 55 | 20-150 | | 55 | 20-150 | H | 70 | 20-150 |
| 13C4-PFHpA | | 58 | 20-150 | | 52 | 20-150 | H | 64 | 20-150 |
| 13C5-PFHxA | | 54 | 20-150 | | 53 | 20-150 | H | 71 | 20-150 |
| 13C5-PFPeA | | 57 | 20-150 | | 52 | 20-150 | H | 63 | 20-150 |
| 13C6-PFDA | | 60 | 20-150 | | 63 | 20-150 | HM-03 | 53 | 20-150 |
| 13C7-PFUnA | | 55 | 20-150 | | 53 | 20-150 | H | 52 | 20-150 |
| 13C8-PFOA | | 52 | 20-150 | M-03 | 48 | 20-150 | HM-03 | 70 | 20-150 |
| 13C8-PFOS | | 54 | 20-150 | | 56 | 20-150 | H | 57 | 20-150 |
| 13C8-PFOSA | | 56 | 20-150 | | 52 | 20-150 | H | 55 | 20-150 |
| 13C9-PFNA | | 56 | 20-150 | M-03 | 56 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 34 | 20-150 | M-03 | 33 | 20-150 | H | 39 | 20-150 |
| D3-NMeFOSAA | | 61 | 20-150 | | 61 | 20-150 | H | 45 | 20-150 |
| D5-NEtFOSA | | 29 | 20-150 | | 26 | 20-150 | H | 34 | 20-150 |
| D5-NEtFOSAA | | 52 | 20-150 | | 48 | 20-150 | HM-03 | 40 | 20-150 |
| D7-NMeFOSE | | 38 | 20-150 | | 36 | 20-150 | H | 48 | 20-150 |
| D9-NEtFOSE | | 31 | 20-150 | | 29 | 20-150 | H | 39 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-012
Description: VRTB-S-G4_10252023 | Matrix: Aqueous
Date Sampled: 10/25/2023 1025 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1847 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1412 | ALM | 11/20/2023 1710 | 90470 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.4 | U | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 8.3 | | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.9 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 23 | | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 8.3 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 470 | M-03 | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 17 | | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 2.6 | M-03 | 0.96 | 0.38 | 0.098 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1100 | M-03 | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 14 | M-03 | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 21 | | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 9.2 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-012
Description: VRTB-S-G4_10252023
Matrix: Aqueous
Date Sampled: 10/25/2023 1025
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 100 | 20-150 | | 93 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 | | 87 | 20-150 |
| 13C2-8:2FTS | | 78 | 20-150 | | 72 | 20-150 |
| 13C2-PFDoA | | 53 | 20-150 | M-03 | 56 | 20-150 |
| 13C2-PFTeDA | | 42 | 20-150 | | 46 | 20-150 |
| 13C3-HFPO-DA | | 83 | 20-150 | | 84 | 20-150 |
| 13C3-PFBS | | 91 | 20-150 | | 85 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 | | 77 | 20-150 |
| 13C4-PFBA | | 82 | 20-150 | | 83 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 | | 76 | 20-150 |
| 13C5-PFHxA | | 84 | 20-150 | | 83 | 20-150 |
| 13C5-PFPeA | | 81 | 20-150 | | 82 | 20-150 |
| 13C6-PFDA | | 74 | 20-150 | | 80 | 20-150 |
| 13C7-PFUnA | | 60 | 20-150 | | 60 | 20-150 |
| 13C8-PFOA | | 81 | 20-150 | | 82 | 20-150 |
| 13C8-PFOS | | 79 | 20-150 | | 75 | 20-150 |
| 13C8-PFOSA | | 77 | 20-150 | | 71 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 | | 75 | 20-150 |
| D3-NMeFOSA | | 63 | 20-150 | | 62 | 20-150 |
| D3-NMeFOSAA | | 72 | 20-150 | | 64 | 20-150 |
| D5-NEtFOSA | | 60 | 20-150 | M-03 | 55 | 20-150 |
| D5-NEtFOSAA | | 65 | 20-150 | | 61 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 | | 64 | 20-150 |
| D9-NEtFOSE | | 61 | 20-150 | | 56 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-013
Description: VRTB-D-M5_10252023 | Matrix: Aqueous
Date Sampled: 10/25/2023 1154 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1915 | ALM | 11/20/2023 1710 | 90470 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.85 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.65 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.4 | U | 4.8 | 4.4 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.96 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.7 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.7 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.56 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 3.3 | | 0.97 | 0.34 | 0.091 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 6.1 | | 3.9 | 1.6 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 3.8 | | 0.97 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 6.2 | | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 65 | M-03 | 0.97 | 0.71 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 9.0 | | 0.97 | 0.39 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.37 | U | 0.97 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.77 | JM-03 | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 260 | M-03 | 0.97 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 6.8 | M-03 | 0.97 | 0.78 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 3.4 | | 0.97 | 0.73 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 8.8 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.58 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-013
Description: VRTB-D-M5_10252023
Matrix: Aqueous
Date Sampled: 10/25/2023 1154
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 91 | 20-150 |
| 13C2-6:2FTS | | 85 | 20-150 |
| 13C2-8:2FTS | | 79 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 |
| 13C2-PFTeDA | | 43 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 |
| 13C3-PFBS | | 84 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 |
| 13C5-PFHxA | | 83 | 20-150 |
| 13C5-PFPeA | | 79 | 20-150 |
| 13C6-PFDA | | 85 | 20-150 |
| 13C7-PFUnA | | 69 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 |
| 13C8-PFOSA | | 82 | 20-150 |
| 13C9-PFNA | | 81 | 20-150 |
| D3-NMeFOSA | | 61 | 20-150 |
| D3-NMeFOSAA | | 74 | 20-150 |
| D5-NEtFOSA | | 58 | 20-150 |
| D5-NEtFOSAA | | 67 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 |
| D9-NEtFOSE | | 59 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-014
Description: VRTB-D-06_10252023 | Matrix: Aqueous
Date Sampled: 10/25/2023 1332 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1924 | ALM | 11/20/2023 1710 | 90470 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.4 | U | 4.2 | 2.4 | 0.91 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.3 | U | 4.2 | 2.3 | 0.70 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.4 | U | 4.2 | 2.4 | 0.69 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.6 | U | 4.2 | 1.6 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.6 | U | 4.2 | 1.6 | 0.41 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.8 | U | 5.2 | 4.8 | 2.1 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 26 | 10 | 4.5 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.5 | U | 4.2 | 2.5 | 1.0 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 10 | 2.0 | 0.63 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.31 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 10 | 2.0 | 0.66 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.4 | U | 2.1 | 1.4 | 0.60 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.2 | U | 2.1 | 1.2 | 0.38 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.67 | U | 2.1 | 0.67 | 0.19 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.4 | U | 2.1 | 1.4 | 0.40 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 2.3 | | 1.0 | 0.35 | 0.097 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 4.1 | J | 4.2 | 1.7 | 0.53 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.17 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 7.5 | | 1.0 | 0.38 | 0.20 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 5.5 | | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 26 | 10 | 4.3 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 72 | M-03 | 1.0 | 0.73 | 0.19 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 9.1 | | 1.0 | 0.40 | 0.15 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 1.0 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.3 | M-03 | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.21 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 270 | M-03 | 1.0 | 0.74 | 0.26 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 7.7 | M-03 | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 4.1 | | 1.0 | 0.75 | 0.27 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 5.7 | | 2.1 | 0.42 | 0.19 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.1 | U | 5.2 | 2.1 | 0.62 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.28 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.26 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-014
Description: VRTB-D-06_10252023
Matrix: Aqueous
Date Sampled: 10/25/2023 1332
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 90 | 20-150 |
| 13C2-6:2FTS | | 85 | 20-150 |
| 13C2-8:2FTS | | 69 | 20-150 |
| 13C2-PFDoA | | 57 | 20-150 |
| 13C2-PFTeDA | | 34 | 20-150 |
| 13C3-HFPO-DA | | 83 | 20-150 |
| 13C3-PFBS | | 82 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 |
| 13C4-PFBA | | 82 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 |
| 13C5-PFPeA | | 81 | 20-150 |
| 13C6-PFDA | | 77 | 20-150 |
| 13C7-PFUnA | | 69 | 20-150 |
| 13C8-PFOA | | 86 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 |
| 13C8-PFOSA | | 73 | 20-150 |
| 13C9-PFNA | | 68 | 20-150 |
| D3-NMeFOSA | | 54 | 20-150 |
| D3-NMeFOSAA | | 61 | 20-150 |
| D5-NEtFOSA | | 48 | 20-150 |
| D5-NEtFOSAA | | 55 | 20-150 |
| D7-NMeFOSE | | 55 | 20-150 |
| D9-NEtFOSE | | 41 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-015
Description: VRTB-D-R7_10252023 | Matrix: Aqueous
Date Sampled: 10/25/2023 1422 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1933 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 1 | 01/02/2024 2007 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.86 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.66 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.66 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.5 | U | 4.9 | 4.5 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.98 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | UQ | 9.9 | 2.0 | 0.60 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 9.9 | 2.0 | 0.62 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.57 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.36 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.8 | | 0.99 | 0.35 | 0.093 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 10 | | 3.9 | 1.6 | 0.50 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.9 | M-03 | 0.99 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 15 | | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 56 | M-03 | 0.99 | 0.72 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 13 | | 0.99 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 0.99 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.0 | M-03 | 0.99 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 92 | M-03 | 0.99 | 0.73 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 11 | M-03 | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 2.0 | | 0.99 | 0.74 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 16 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.59 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-015
Description: VRTB-D-R7_10252023
Matrix: Aqueous
Date Sampled: 10/25/2023 1422
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 | H | 82 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 | H | 81 | 20-150 |
| 13C2-8:2FTS | | 78 | 20-150 | H | 76 | 20-150 |
| 13C2-PFDoA | | 48 | 20-150 | H | 61 | 20-150 |
| 13C2-PFTeDA | | 29 | 20-150 | H | 36 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 | H | 79 | 20-150 |
| 13C3-PFBS | | 86 | 20-150 | H | 85 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 | H | 73 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | H | 80 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 | H | 83 | 20-150 |
| 13C5-PFHxA | | 85 | 20-150 | H | 77 | 20-150 |
| 13C5-PFPeA | | 82 | 20-150 | H | 83 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 65 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOS | | 81 | 20-150 | H | 85 | 20-150 |
| 13C8-PFOSA | | 72 | 20-150 | H | 82 | 20-150 |
| 13C9-PFNA | | 72 | 20-150 | H | 86 | 20-150 |
| D3-NMeFOSA | | 47 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | | 56 | 20-150 | H | 66 | 20-150 |
| D5-NEtFOSA | | 42 | 20-150 | H | 56 | 20-150 |
| D5-NEtFOSAA | | 43 | 20-150 | H | 66 | 20-150 |
| D7-NMeFOSE | | 26 | 20-150 | H | 38 | 20-150 |
| D9-NEtFOSE | N | 12 | 20-150 | H | 23 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-015
Description: VRTB-D-R7_10252023 | Matrix: Aqueous
Date Sampled: 10/25/2023 1422 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1933 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 1 | 01/02/2024 2007 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | UH | 4.0 | 2.3 | 0.88 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | UH | 4.0 | 2.2 | 0.67 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | UH | 4.0 | 2.3 | 0.67 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | UH | 4.0 | 1.5 | 0.61 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | UH | 4.0 | 1.5 | 0.40 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.6 | UH | 5.0 | 4.6 | 2.0 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | UH | 25 | 10 | 4.3 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | UH | 4.0 | 2.4 | 1.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | UH | 1.0 | 0.40 | 0.13 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | UH | 1.0 | 0.80 | 0.29 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | UH | 10 | 2.0 | 0.61 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | UH | 1.0 | 0.80 | 0.22 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | UH | 1.0 | 0.80 | 0.30 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | UH | 10 | 2.0 | 0.63 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | UH | 2.0 | 1.3 | 0.58 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | UH | 2.0 | 1.1 | 0.36 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | UH | 2.0 | 0.64 | 0.19 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | UH | 2.0 | 1.3 | 0.39 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.9 | H | 1.0 | 0.35 | 0.094 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 11 | H | 4.0 | 1.6 | 0.51 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | UH | 1.0 | 0.39 | 0.17 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | UH | 1.0 | 0.40 | 0.14 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | UH | 1.0 | 0.39 | 0.15 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | UH | 1.0 | 0.40 | 0.11 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.9 | H | 1.0 | 0.38 | 0.19 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 16 | H | 1.0 | 0.80 | 0.21 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | UH | 25 | 10 | 4.2 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 72 | HM-03 | 1.0 | 0.73 | 0.18 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 16 | H | 1.0 | 0.40 | 0.14 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | UH | 1.0 | 0.38 | 0.15 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.89 | HJM-03 | 1.0 | 0.40 | 0.10 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | UH | 1.0 | 0.40 | 0.20 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 91 | HM-03 | 1.0 | 0.74 | 0.25 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 13 | HM-03 | 1.0 | 0.80 | 0.21 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 2.6 | H | 1.0 | 0.75 | 0.26 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 18 | H | 2.0 | 0.40 | 0.19 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.60 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | UH | 1.0 | 0.80 | 0.27 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | UH | 1.0 | 0.40 | 0.19 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | UH | 1.0 | 0.80 | 0.25 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-015
Description: VRTB-D-R7_10252023
Matrix: Aqueous
Date Sampled: 10/25/2023 1422
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 | H | 82 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 | H | 81 | 20-150 |
| 13C2-8:2FTS | | 78 | 20-150 | H | 76 | 20-150 |
| 13C2-PFDoA | | 48 | 20-150 | H | 61 | 20-150 |
| 13C2-PFTeDA | | 29 | 20-150 | H | 36 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 | H | 79 | 20-150 |
| 13C3-PFBS | | 86 | 20-150 | H | 85 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 | H | 73 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | H | 80 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 | H | 83 | 20-150 |
| 13C5-PFHxA | | 85 | 20-150 | H | 77 | 20-150 |
| 13C5-PFPeA | | 82 | 20-150 | H | 83 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 65 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOS | | 81 | 20-150 | H | 85 | 20-150 |
| 13C8-PFOSA | | 72 | 20-150 | H | 82 | 20-150 |
| 13C9-PFNA | | 72 | 20-150 | H | 86 | 20-150 |
| D3-NMeFOSA | | 47 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | | 56 | 20-150 | H | 66 | 20-150 |
| D5-NEtFOSA | | 42 | 20-150 | H | 56 | 20-150 |
| D5-NEtFOSAA | | 43 | 20-150 | H | 66 | 20-150 |
| D7-NMeFOSE | | 26 | 20-150 | H | 38 | 20-150 |
| D9-NEtFOSE | N | 12 | 20-150 | H | 23 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-016
Description: VRTB-D-P8_10252023 | Matrix: Aqueous
Date Sampled: 10/25/2023 1539 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1942 | ALM | 11/20/2023 1710 | 90470 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.83 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.4 | U | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.94 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.5 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.5 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.5 | | 0.95 | 0.33 | 0.089 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 15 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 2.9 | | 0.95 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 25 | | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 86 | M-03 | 0.95 | 0.69 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 26 | | 0.95 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.95 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 5.8 | | 0.95 | 0.38 | 0.098 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 210 | M-03 | 0.95 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 19 | M-03 | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 3.6 | | 0.95 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 27 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-016
Description: VRTB-D-P8_10252023
Matrix: Aqueous
Date Sampled: 10/25/2023 1539
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 92 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 |
| 13C2-8:2FTS | | 77 | 20-150 |
| 13C2-PFDoA | | 63 | 20-150 |
| 13C2-PFTeDA | | 39 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 |
| 13C3-PFBS | | 88 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 |
| 13C4-PFBA | | 86 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 |
| 13C5-PFHxA | | 84 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 |
| 13C6-PFDA | | 90 | 20-150 |
| 13C7-PFUnA | | 70 | 20-150 |
| 13C8-PFOA | | 80 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 |
| 13C8-PFOSA | | 82 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 |
| D3-NMeFOSA | | 62 | 20-150 |
| D3-NMeFOSAA | | 73 | 20-150 |
| D5-NEtFOSA | | 54 | 20-150 |
| D5-NEtFOSAA | | 65 | 20-150 |
| D7-NMeFOSE | | 67 | 20-150 |
| D9-NEtFOSE | | 52 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-017
Description: CMT-VRTB-01_6_10252023 | Matrix: Aqueous
Date Sampled: 10/25/2023 1726 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 1951 | ALM | 11/20/2023 1710 | 90470 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.88 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | U | 4.0 | 2.2 | 0.67 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.67 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.40 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.6 | U | 5.0 | 4.6 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.3 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | U | 4.0 | 2.4 | 1.0 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 10 | 2.0 | 0.61 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 10 | 2.0 | 0.63 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.58 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.36 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.19 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.39 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.1 | | 1.0 | 0.35 | 0.094 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 9.2 | | 4.0 | 1.6 | 0.51 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.17 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 9.5 | | 1.0 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 9.1 | | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.2 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 190 | M-03 | 1.0 | 0.73 | 0.19 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 15 | | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 1.0 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.2 | M-03 | 1.0 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 370 | M-03 | 1.0 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 19 | M-03 | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 13 | | 1.0 | 0.75 | 0.26 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 12 | | 2.0 | 0.40 | 0.19 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.60 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-017
Description: CMT-VRTB-01_6_10252023
Matrix: Aqueous
Date Sampled: 10/25/2023 1726
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 86 | 20-150 |
| 13C2-6:2FTS | | 80 | 20-150 |
| 13C2-8:2FTS | | 69 | 20-150 |
| 13C2-PFDoA | | 65 | 20-150 |
| 13C2-PFTeDA | | 55 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 |
| 13C3-PFBS | | 85 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 |
| 13C4-PFHpA | | 79 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 |
| 13C5-PFPeA | | 79 | 20-150 |
| 13C6-PFDA | | 71 | 20-150 |
| 13C7-PFUnA | | 62 | 20-150 |
| 13C8-PFOA | | 80 | 20-150 |
| 13C8-PFOS | | 68 | 20-150 |
| 13C8-PFOSA | | 68 | 20-150 |
| 13C9-PFNA | | 72 | 20-150 |
| D3-NMeFOSA | | 58 | 20-150 |
| D3-NMeFOSAA | | 67 | 20-150 |
| D5-NEtFOSA | | 57 | 20-150 |
| D5-NEtFOSAA | | 63 | 20-150 |
| D7-NMeFOSE | | 66 | 20-150 |
| D9-NEtFOSE | | 61 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-018
Description: VRTB-D-B1_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 0920 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 2000 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1421 | ALM | 11/20/2023 1710 | 90470 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.87 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | U | 4.0 | 2.2 | 0.67 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.66 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 3.1 | JM-03 | 4.0 | 1.5 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.40 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 14 | | 5.0 | 4.6 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.3 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | U | 4.0 | 2.4 | 0.99 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 10 | 2.0 | 0.61 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 10 | 2.0 | 0.63 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.58 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.36 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.39 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 11 | | 1.0 | 0.35 | 0.093 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 21 | | 4.0 | 1.6 | 0.51 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 29 | | 1.0 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 39 | | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.2 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 480 | M-03 | 1.0 | 0.73 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 54 | | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 1.0 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 12 | M-03 | 1.0 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.26 | JM-03 | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1800 | M-03 | 5.0 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 58 | M-03 | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 23 | | 1.0 | 0.75 | 0.26 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 40 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.59 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-018
Description: VRTB-D-B1_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 0920
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 20-150 | | 97 | 20-150 |
| 13C2-6:2FTS | | 88 | 20-150 | | 89 | 20-150 |
| 13C2-8:2FTS | | 79 | 20-150 | M-03 | 75 | 20-150 |
| 13C2-PFDoA | | 57 | 20-150 | | 61 | 20-150 |
| 13C2-PFTeDA | | 32 | 20-150 | | 36 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 | | 93 | 20-150 |
| 13C3-PFBS | | 91 | 20-150 | | 90 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 | | 84 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 | | 84 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 | | 81 | 20-150 |
| 13C5-PFHxA | | 84 | 20-150 | | 87 | 20-150 |
| 13C5-PFPeA | | 83 | 20-150 | | 85 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 | | 76 | 20-150 |
| 13C7-PFUnA | | 68 | 20-150 | M-03 | 66 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 | | 90 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 | | 76 | 20-150 |
| 13C8-PFOSA | | 93 | 20-150 | | 78 | 20-150 |
| 13C9-PFNA | | 75 | 20-150 | | 78 | 20-150 |
| D3-NMeFOSA | | 77 | 20-150 | | 64 | 20-150 |
| D3-NMeFOSAA | M-03 | 98 | 20-150 | M-03 | 68 | 20-150 |
| D5-NEtFOSA | | 70 | 20-150 | | 57 | 20-150 |
| D5-NEtFOSAA | | 81 | 20-150 | | 73 | 20-150 |
| D7-NMeFOSE | | 63 | 20-150 | | 54 | 20-150 |
| D9-NEtFOSE | | 30 | 20-150 | | 26 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-019
Description: VRTB-D-S2_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1006 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 2009 | ALM | 11/20/2023 1710 | 90470 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.87 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | U | 4.0 | 2.2 | 0.66 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.66 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.6 | U | 5.0 | 4.6 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.3 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | U | 4.0 | 2.4 | 0.98 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 9.9 | 2.0 | 0.60 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 9.9 | 2.0 | 0.63 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.57 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.36 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.39 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 17 | | 0.99 | 0.35 | 0.093 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 6.2 | | 4.0 | 1.6 | 0.51 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 8.3 | | 0.99 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 7.0 | | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 170 | M-03 | 0.99 | 0.72 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 13 | | 0.99 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 0.99 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.75 | JM-03 | 0.99 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 290 | M-03 | 0.99 | 0.73 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 14 | M-03 | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 37 | | 0.99 | 0.74 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 8.5 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.59 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-019
Description: VRTB-D-S2_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1006
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 100 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 |
| 13C2-8:2FTS | | 81 | 20-150 |
| 13C2-PFDoA | | 48 | 20-150 |
| 13C2-PFTeDA | | 24 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 |
| 13C3-PFBS | | 90 | 20-150 |
| 13C3-PFHxS | | 91 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 |
| 13C5-PFHxA | | 86 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 |
| 13C6-PFDA | | 75 | 20-150 |
| 13C7-PFUnA | | 64 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 |
| 13C8-PFOSA | | 83 | 20-150 |
| 13C9-PFNA | | 82 | 20-150 |
| D3-NMeFOSA | | 54 | 20-150 |
| D3-NMeFOSAA | | 67 | 20-150 |
| D5-NEtFOSA | | 51 | 20-150 |
| D5-NEtFOSAA | | 60 | 20-150 |
| D7-NMeFOSE | | 54 | 20-150 |
| D9-NEtFOSE | | 32 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-020
Description: VRTB-D-Y3_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1100 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1044 | ARC2 | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 1 | 01/02/2024 2016 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.87 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | U | 4.0 | 2.2 | 0.67 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.66 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.40 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.6 | U | 5.0 | 4.6 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.3 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | U | 4.0 | 2.4 | 0.99 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | UQ | 10 | 2.0 | 0.61 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 10 | 2.0 | 0.63 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.58 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.36 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.39 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 2.7 | | 1.0 | 0.35 | 0.093 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 3.1 | JM-03 | 4.0 | 1.6 | 0.51 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 2.3 | | 1.0 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 2.3 | | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.2 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 51 | | 1.0 | 0.73 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 3.6 | | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 1.0 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.53 | JM-03 | 1.0 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 98 | M-03 | 1.0 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 4.3 | M-03 | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 7.0 | | 1.0 | 0.75 | 0.26 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 2.3 | M-03 | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.59 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-020
Description: VRTB-D-Y3_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1100
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 106 | 20-150 | H | 65 | 20-150 |
| 13C2-6:2FTS | | 94 | 20-150 | H | 63 | 20-150 |
| 13C2-8:2FTS | M-03 | 65 | 20-150 | H | 61 | 20-150 |
| 13C2-PFDoA | | 51 | 20-150 | H | 46 | 20-150 |
| 13C2-PFTeDA | | 30 | 20-150 | H | 22 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 | H | 67 | 20-150 |
| 13C3-PFBS | | 84 | 20-150 | H | 67 | 20-150 |
| 13C3-PFHxS | | 78 | 20-150 | H | 61 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 | H | 68 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | H | 70 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | H | 69 | 20-150 |
| 13C5-PFPeA | | 113 | 20-150 | H | 72 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 | H | 66 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 | H | 57 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOS | | 77 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOSA | | 74 | 20-150 | H | 64 | 20-150 |
| 13C9-PFNA | | 90 | 20-150 | H | 69 | 20-150 |
| D3-NMeFOSA | | 48 | 20-150 | H | 53 | 20-150 |
| D3-NMeFOSAA | | 64 | 20-150 | H | 55 | 20-150 |
| D5-NEtFOSA | | 45 | 20-150 | H | 47 | 20-150 |
| D5-NEtFOSAA | | 50 | 20-150 | H | 57 | 20-150 |
| D7-NMeFOSE | | 38 | 20-150 | H | 42 | 20-150 |
| D9-NEtFOSE | N | 19 | 20-150 | H | 31 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-020
Description: VRTB-D-Y3_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1100 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1044 | ARC2 | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 1 | 01/02/2024 2016 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | UH | 3.8 | 2.2 | 0.83 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | UH | 3.8 | 2.1 | 0.64 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | UH | 3.8 | 2.2 | 0.63 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | UH | 3.8 | 1.4 | 0.58 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | UH | 3.8 | 1.4 | 0.38 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.4 | UH | 4.8 | 4.4 | 1.9 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | UH | 24 | 9.6 | 4.1 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | UH | 3.8 | 2.3 | 0.95 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | UH | 0.95 | 0.38 | 0.12 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.76 | UH | 0.95 | 0.76 | 0.28 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UH | 9.5 | 1.9 | 0.58 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.76 | UH | 0.95 | 0.76 | 0.20 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.76 | UH | 0.95 | 0.76 | 0.28 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UH | 9.5 | 1.9 | 0.60 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UH | 1.9 | 1.2 | 0.55 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | UH | 1.9 | 1.0 | 0.34 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | UH | 1.9 | 0.61 | 0.18 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UH | 1.9 | 1.2 | 0.37 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 3.1 | H | 0.95 | 0.33 | 0.089 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 3.4 | HJ | 3.8 | 1.5 | 0.49 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | UH | 0.95 | 0.37 | 0.16 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | UH | 0.95 | 0.38 | 0.13 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | UH | 0.95 | 0.37 | 0.15 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | UH | 0.95 | 0.38 | 0.10 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 2.0 | H | 0.95 | 0.36 | 0.18 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 2.6 | H | 0.95 | 0.76 | 0.20 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | UH | 24 | 9.6 | 4.0 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 68 | HM-03 | 0.95 | 0.69 | 0.18 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 4.1 | H | 0.95 | 0.38 | 0.14 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | UH | 0.95 | 0.36 | 0.14 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.37 | HJM-03 | 0.95 | 0.38 | 0.098 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.38 | UHM-03 | 0.95 | 0.38 | 0.19 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 100 | HM-03 | 0.95 | 0.70 | 0.24 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 5.4 | HM-03 | 0.95 | 0.76 | 0.20 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 7.5 | H | 0.95 | 0.71 | 0.24 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 2.6 | H | 1.9 | 0.38 | 0.18 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | UH | 4.8 | 1.9 | 0.57 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.76 | UH | 0.95 | 0.76 | 0.26 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | UH | 0.95 | 0.38 | 0.18 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.76 | UH | 0.95 | 0.76 | 0.24 | ng/L | 2 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-020
Description: VRTB-D-Y3_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1100
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 106 | 20-150 | H | 65 | 20-150 |
| 13C2-6:2FTS | | 94 | 20-150 | H | 63 | 20-150 |
| 13C2-8:2FTS | M-03 | 65 | 20-150 | H | 61 | 20-150 |
| 13C2-PFDoA | | 51 | 20-150 | H | 46 | 20-150 |
| 13C2-PFTeDA | | 30 | 20-150 | H | 22 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 | H | 67 | 20-150 |
| 13C3-PFBS | | 84 | 20-150 | H | 67 | 20-150 |
| 13C3-PFHxS | | 78 | 20-150 | H | 61 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 | H | 68 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | H | 70 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | H | 69 | 20-150 |
| 13C5-PFPeA | | 113 | 20-150 | H | 72 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 | H | 66 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 | H | 57 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOS | | 77 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOSA | | 74 | 20-150 | H | 64 | 20-150 |
| 13C9-PFNA | | 90 | 20-150 | H | 69 | 20-150 |
| D3-NMeFOSA | | 48 | 20-150 | H | 53 | 20-150 |
| D3-NMeFOSAA | | 64 | 20-150 | H | 55 | 20-150 |
| D5-NEtFOSA | | 45 | 20-150 | H | 47 | 20-150 |
| D5-NEtFOSAA | | 50 | 20-150 | H | 57 | 20-150 |
| D7-NMeFOSE | | 38 | 20-150 | H | 42 | 20-150 |
| D9-NEtFOSE | N | 19 | 20-150 | H | 31 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-021
Description: VRTB-D-G4_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1148 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1100 | ARC2 | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 1 | 01/02/2024 2044 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.87 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | U | 4.0 | 2.2 | 0.66 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.66 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.5 | U | 4.9 | 4.5 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.3 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | U | 4.0 | 2.4 | 0.98 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | UQ | 9.9 | 2.0 | 0.60 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 9.9 | 2.0 | 0.62 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.57 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.36 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 0.92 | J | 0.99 | 0.35 | 0.093 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 5.5 | | 4.0 | 1.6 | 0.50 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.7 | | 0.99 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 3.1 | | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 34 | | 0.99 | 0.72 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 8.3 | | 0.99 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 0.99 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.45 | JM-03 | 0.99 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 110 | M-03 | 0.99 | 0.73 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 3.2 | M-03 | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 2.0 | M-03 | 0.99 | 0.74 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 12 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.59 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-021
Description: VRTB-D-G4_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1148
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 110 | 20-150 | H | 78 | 20-150 |
| 13C2-6:2FTS | | 102 | 20-150 | H | 78 | 20-150 |
| 13C2-8:2FTS | M-03 | 74 | 20-150 | H | 74 | 20-150 |
| 13C2-PFDoA | | 51 | 20-150 | H | 57 | 20-150 |
| 13C2-PFTeDA | | 42 | 20-150 | H | 41 | 20-150 |
| 13C3-HFPO-DA | | 98 | 20-150 | H | 80 | 20-150 |
| 13C3-PFBS | | 108 | 20-150 | H | 87 | 20-150 |
| 13C3-PFHxS | | 91 | 20-150 | H | 78 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | H | 86 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | H | 87 | 20-150 |
| 13C5-PFHxA | | 95 | 20-150 | H | 84 | 20-150 |
| 13C5-PFPeA | | 119 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 90 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 64 | 20-150 | H | 69 | 20-150 |
| 13C8-PFOA | | 129 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOS | | 90 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOSA | | 82 | 20-150 | H | 74 | 20-150 |
| 13C9-PFNA | | 91 | 20-150 | H | 90 | 20-150 |
| D3-NMeFOSA | | 59 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | | 62 | 20-150 | H | 71 | 20-150 |
| D5-NEtFOSA | | 52 | 20-150 | H | 54 | 20-150 |
| D5-NEtFOSAA | | 46 | 20-150 | H | 66 | 20-150 |
| D7-NMeFOSE | | 28 | 20-150 | H | 52 | 20-150 |
| D9-NEtFOSE | N | 12 | 20-150 | H | 43 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-021
Description: VRTB-D-G4_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1148 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1100 | ARC2 | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 1 | 01/02/2024 2044 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | UH | 4.0 | 2.3 | 0.87 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | UH | 4.0 | 2.2 | 0.67 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | UH | 4.0 | 2.3 | 0.66 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | UH | 4.0 | 1.5 | 0.61 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | UH | 4.0 | 1.5 | 0.40 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.6 | UH | 5.0 | 4.6 | 2.0 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | UH | 25 | 10 | 4.3 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | UH | 4.0 | 2.4 | 0.99 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | UH | 1.0 | 0.40 | 0.13 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | UH | 1.0 | 0.80 | 0.29 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | UH | 10 | 2.0 | 0.61 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | UH | 1.0 | 0.80 | 0.21 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | UH | 1.0 | 0.80 | 0.29 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | UH | 10 | 2.0 | 0.63 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | UH | 2.0 | 1.3 | 0.57 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | UH | 2.0 | 1.1 | 0.36 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | UH | 2.0 | 0.64 | 0.18 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | UH | 2.0 | 1.3 | 0.39 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 0.91 | HJ | 1.0 | 0.35 | 0.093 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 6.4 | H | 4.0 | 1.6 | 0.51 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | UH | 1.0 | 0.39 | 0.16 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | UH | 1.0 | 0.40 | 0.13 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | UH | 1.0 | 0.39 | 0.15 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | UH | 1.0 | 0.40 | 0.11 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.6 | HM-03 | 1.0 | 0.38 | 0.19 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 3.3 | H | 1.0 | 0.80 | 0.21 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | UH | 25 | 10 | 4.2 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 38 | H | 1.0 | 0.73 | 0.18 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 10 | H | 1.0 | 0.40 | 0.14 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | UH | 1.0 | 0.38 | 0.15 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.40 | HJM-03 | 1.0 | 0.40 | 0.10 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | UH | 1.0 | 0.40 | 0.20 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 110 | HM-03 | 1.0 | 0.74 | 0.25 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 4.5 | HM-03 | 1.0 | 0.80 | 0.21 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 2.2 | H | 1.0 | 0.75 | 0.26 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 13 | H | 2.0 | 0.40 | 0.18 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.59 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | UH | 1.0 | 0.80 | 0.27 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | UH | 1.0 | 0.40 | 0.19 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | UH | 1.0 | 0.80 | 0.25 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-021
Description: VRTB-D-G4_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1148
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 110 | 20-150 | H | 78 | 20-150 |
| 13C2-6:2FTS | | 102 | 20-150 | H | 78 | 20-150 |
| 13C2-8:2FTS | M-03 | 74 | 20-150 | H | 74 | 20-150 |
| 13C2-PFDoA | | 51 | 20-150 | H | 57 | 20-150 |
| 13C2-PFTeDA | | 42 | 20-150 | H | 41 | 20-150 |
| 13C3-HFPO-DA | | 98 | 20-150 | H | 80 | 20-150 |
| 13C3-PFBS | | 108 | 20-150 | H | 87 | 20-150 |
| 13C3-PFHxS | | 91 | 20-150 | H | 78 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | H | 86 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | H | 87 | 20-150 |
| 13C5-PFHxA | | 95 | 20-150 | H | 84 | 20-150 |
| 13C5-PFPeA | | 119 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 90 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 64 | 20-150 | H | 69 | 20-150 |
| 13C8-PFOA | | 129 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOS | | 90 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOSA | | 82 | 20-150 | H | 74 | 20-150 |
| 13C9-PFNA | | 91 | 20-150 | H | 90 | 20-150 |
| D3-NMeFOSA | | 59 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | | 62 | 20-150 | H | 71 | 20-150 |
| D5-NEtFOSA | | 52 | 20-150 | H | 54 | 20-150 |
| D5-NEtFOSAA | | 46 | 20-150 | H | 66 | 20-150 |
| D7-NMeFOSE | | 28 | 20-150 | H | 52 | 20-150 |
| D9-NEtFOSE | N | 12 | 20-150 | H | 43 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-022
Description: VRTB-S-06_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1303 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1116 | ARC2 | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 5 | 12/17/2023 1423 | BWS | 11/21/2023 1051 | 90523 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.7 | JM-03 | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | UQ | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 2.6 | JM-03 | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 8.0 | | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 15 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.20 | J | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.76 | JM-03 | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 65 | M-03 | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 20 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 510 | M-03 | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 39 | M-03 | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.75 | JM-03 | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 8.1 | M-03 | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 4.9 | M-03 | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1700 | M-03 | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 42 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 29 | | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 25 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-022
Description: VRTB-S-06_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1303
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | N | 157 | 20-150 | | 116 | 20-150 |
| 13C2-6:2FTS | | 111 | 20-150 | | 113 | 20-150 |
| 13C2-8:2FTS | M-03 | 79 | 20-150 | M-03 | 91 | 20-150 |
| 13C2-PFDoA | | 73 | 20-150 | | 64 | 20-150 |
| 13C2-PFTeDA | | 53 | 20-150 | | 46 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 | | 96 | 20-150 |
| 13C3-PFBS | | 123 | 20-150 | | 109 | 20-150 |
| 13C3-PFHxS | | 88 | 20-150 | | 104 | 20-150 |
| 13C4-PFBA | | 98 | 20-150 | | 97 | 20-150 |
| 13C4-PFHpA | | 89 | 20-150 | | 91 | 20-150 |
| 13C5-PFHxA | | 91 | 20-150 | | 95 | 20-150 |
| 13C5-PFPeA | | 107 | 20-150 | | 93 | 20-150 |
| 13C6-PFDA | | 104 | 20-150 | | 89 | 20-150 |
| 13C7-PFUnA | | 85 | 20-150 | | 67 | 20-150 |
| 13C8-PFOA | | 106 | 20-150 | | 96 | 20-150 |
| 13C8-PFOS | | 90 | 20-150 | | 91 | 20-150 |
| 13C8-PFOSA | | 111 | 20-150 | | 96 | 20-150 |
| 13C9-PFNA | | 97 | 20-150 | | 97 | 20-150 |
| D3-NMeFOSA | | 97 | 20-150 | | 69 | 20-150 |
| D3-NMeFOSAA | | 100 | 20-150 | | 91 | 20-150 |
| D5-NEtFOSA | | 89 | 20-150 | | 70 | 20-150 |
| D5-NEtFOSAA | | 73 | 20-150 | | 76 | 20-150 |
| D7-NMeFOSE | | 87 | 20-150 | | 71 | 20-150 |
| D9-NEtFOSE | | 70 | 20-150 | | 52 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-023
Description: VRTB-S-M5_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1431 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1133 | ARC2 | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 10 | 12/17/2023 1432 | BWS | 11/21/2023 1051 | 90523 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.87 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | U | 4.0 | 2.2 | 0.66 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.66 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 11 | | 4.0 | 1.5 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | UQ | 4.0 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 11 | M-03 | 5.0 | 4.6 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.3 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | U | 4.0 | 2.4 | 0.98 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 9.9 | 2.0 | 0.60 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 9.9 | 2.0 | 0.62 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.57 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.36 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.39 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.0 | | 0.99 | 0.35 | 0.093 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 13 | | 4.0 | 1.6 | 0.51 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.25 | JM-03 | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 30 | | 0.99 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 26 | | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 440 | | 0.99 | 0.72 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 45 | M-03 | 0.99 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 0.99 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 11 | M-03 | 0.99 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.48 | JM-03 | 0.99 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2500 | M-03 | 9.9 | 7.3 | 2.4 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 47 | | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 16 | | 0.99 | 0.74 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 29 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.59 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-023
Description: VRTB-S-M5_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1431
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | N | 187 | 20-150 | | 114 | 20-150 |
| 13C2-6:2FTS | | 129 | 20-150 | | 93 | 20-150 |
| 13C2-8:2FTS | M-03 | 94 | 20-150 | | 100 | 20-150 |
| 13C2-PFDoA | | 66 | 20-150 | M-03 | 67 | 20-150 |
| 13C2-PFTeDA | | 45 | 20-150 | | 45 | 20-150 |
| 13C3-HFPO-DA | | 101 | 20-150 | | 93 | 20-150 |
| 13C3-PFBS | | 119 | 20-150 | | 99 | 20-150 |
| 13C3-PFHxS | | 103 | 20-150 | | 102 | 20-150 |
| 13C4-PFBA | | 97 | 20-150 | | 95 | 20-150 |
| 13C4-PFHpA | | 90 | 20-150 | | 86 | 20-150 |
| 13C5-PFHxA | | 95 | 20-150 | | 94 | 20-150 |
| 13C5-PFPeA | | 108 | 20-150 | | 92 | 20-150 |
| 13C6-PFDA | | 99 | 20-150 | M-03 | 101 | 20-150 |
| 13C7-PFUnA | | 77 | 20-150 | | 76 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 | | 104 | 20-150 |
| 13C8-PFOS | M-03 | 100 | 20-150 | | 74 | 20-150 |
| 13C8-PFOSA | | 130 | 20-150 | | 84 | 20-150 |
| 13C9-PFNA | | 94 | 20-150 | | 98 | 20-150 |
| D3-NMeFOSA | | 99 | 20-150 | | 67 | 20-150 |
| D3-NMeFOSAA | | 117 | 20-150 | | 82 | 20-150 |
| D5-NEtFOSA | | 97 | 20-150 | | 62 | 20-150 |
| D5-NEtFOSAA | | 81 | 20-150 | M-03 | 67 | 20-150 |
| D7-NMeFOSE | | 90 | 20-150 | | 57 | 20-150 |
| D9-NEtFOSE | | 68 | 20-150 | M-03 | 45 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-024
Description: VRTB-S-R7_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1549 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1415 | MMM | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 1 | 01/02/2024 2053 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.81 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.62 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 63 | | 3.7 | 1.4 | 0.56 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | UQ | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 87 | Q | 4.6 | 4.2 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.92 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | UQ | 0.93 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.56 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | UQ | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | UQ | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.58 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.53 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UM-03 | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 33 | | 0.93 | 0.33 | 0.087 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 71 | | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.34 | JM-03 | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.099 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 300 | | 0.93 | 0.35 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 160 | | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2100 | EM-03 | 0.93 | 0.68 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 300 | | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.8 | M-03 | 0.93 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 73 | M-03 | 0.93 | 0.37 | 0.095 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.7 | QM-03 | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 22000 | EM-03 | 0.93 | 0.69 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 260 | | 0.93 | 0.74 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 110 | | 0.93 | 0.70 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 160 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-024
Description: VRTB-S-R7_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1549
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | N | 212 | 20-150 | H | 66 | 20-150 |
| 13C2-6:2FTS | N | 162 | 20-150 | H | 62 | 20-150 |
| 13C2-8:2FTS | | 115 | 20-150 | H | 52 | 20-150 |
| 13C2-PFDoA | | 66 | 20-150 | H | 68 | 20-150 |
| 13C2-PFTeDA | | 50 | 20-150 | H | 67 | 20-150 |
| 13C3-HFPO-DA | | 108 | 20-150 | H | 65 | 20-150 |
| 13C3-PFBS | | 148 | 20-150 | H | 67 | 20-150 |
| 13C3-PFHxS | | 94 | 20-150 | H | 64 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | H | 69 | 20-150 |
| 13C4-PFHpA | | 87 | 20-150 | H | 66 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | H | 68 | 20-150 |
| 13C5-PFPeA | | 117 | 20-150 | H | 69 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | H | 67 | 20-150 |
| 13C7-PFUnA | | 84 | 20-150 | H | 70 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 | H | 64 | 20-150 |
| 13C8-PFOS | | 92 | 20-150 | H | 67 | 20-150 |
| 13C8-PFOSA | N | 219 | 20-150 | H | 70 | 20-150 |
| 13C9-PFNA | | 94 | 20-150 | H | 64 | 20-150 |
| D3-NMeFOSA | N | 180 | 20-150 | H | 51 | 20-150 |
| D3-NMeFOSAA | N | 194 | 20-150 | H | 80 | 20-150 |
| D5-NEtFOSA | N | 176 | 20-150 | H | 50 | 20-150 |
| D5-NEtFOSAA | | 110 | 20-150 | H | 72 | 20-150 |
| D7-NMeFOSE | | 70 | 20-150 | H | 64 | 20-150 |
| D9-NEtFOSE | | 25 | 20-150 | H | 63 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-024
Description: VRTB-S-R7_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1549 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1415 | MMM | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 1 | 01/02/2024 2053 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 62 | HJM-03 | 200 | 75 | 30 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 150 | HJ | 250 | 230 | 100 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 44 | HJ | 50 | 18 | 4.7 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 94 | HJ | 200 | 80 | 26 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 160 | H | 50 | 19 | 9.5 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 200 | HM-03 | 50 | 40 | 11 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2500 | H | 50 | 37 | 9.2 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 400 | H | 50 | 20 | 7.1 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 93 | HM-03 | 50 | 20 | 5.2 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 26000 | HM-03 | 50 | 37 | 12 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 320 | HM-03 | 50 | 40 | 10 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 110 | H | 50 | 38 | 13 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 220 | H | 100 | 20 | 9.2 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 2 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-024
Description: VRTB-S-R7_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1549
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | N | 212 | 20-150 | H | 66 | 20-150 |
| 13C2-6:2FTS | N | 162 | 20-150 | H | 62 | 20-150 |
| 13C2-8:2FTS | | 115 | 20-150 | H | 52 | 20-150 |
| 13C2-PFDoA | | 66 | 20-150 | H | 68 | 20-150 |
| 13C2-PFTeDA | | 50 | 20-150 | H | 67 | 20-150 |
| 13C3-HFPO-DA | | 108 | 20-150 | H | 65 | 20-150 |
| 13C3-PFBS | | 148 | 20-150 | H | 67 | 20-150 |
| 13C3-PFHxS | | 94 | 20-150 | H | 64 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | H | 69 | 20-150 |
| 13C4-PFHpA | | 87 | 20-150 | H | 66 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | H | 68 | 20-150 |
| 13C5-PFPeA | | 117 | 20-150 | H | 69 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | H | 67 | 20-150 |
| 13C7-PFUnA | | 84 | 20-150 | H | 70 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 | H | 64 | 20-150 |
| 13C8-PFOS | | 92 | 20-150 | H | 67 | 20-150 |
| 13C8-PFOSA | N | 219 | 20-150 | H | 70 | 20-150 |
| 13C9-PFNA | | 94 | 20-150 | H | 64 | 20-150 |
| D3-NMeFOSA | N | 180 | 20-150 | H | 51 | 20-150 |
| D3-NMeFOSAA | N | 194 | 20-150 | H | 80 | 20-150 |
| D5-NEtFOSA | N | 176 | 20-150 | H | 50 | 20-150 |
| D5-NEtFOSAA | | 110 | 20-150 | H | 72 | 20-150 |
| D7-NMeFOSE | | 70 | 20-150 | H | 64 | 20-150 |
| D9-NEtFOSE | | 25 | 20-150 | H | 63 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-025
Description: VRTB-L-S2_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1703
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1431 | MMM | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 5 | 12/18/2023 1813 | MMM | 11/21/2023 1051 | 90523 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 2102 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.86 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | U | 4.0 | 2.2 | 0.66 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.66 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 11 | | 4.0 | 1.5 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 5.6 | | 4.9 | 4.5 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | U | 4.0 | 2.4 | 0.98 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | UQ | 9.9 | 2.0 | 0.60 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | UQ | 9.9 | 2.0 | 0.62 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.57 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.36 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.1 | M-03 | 0.99 | 0.35 | 0.093 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.3 | | 4.0 | 1.6 | 0.50 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 15 | M-03 | 0.99 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 11 | | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 210 | M-03 | 0.99 | 0.72 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 16 | M-03 | 0.99 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 0.99 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 5.4 | | 0.99 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.2 | M-03 | 0.99 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 950 | EM-03 | 0.99 | 0.73 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 28 | | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 10 | M-03 | 0.99 | 0.74 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 12 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.59 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-025
Description: VRTB-L-S2_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1703
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 105 | 20-150 | | 84 | 20-150 | H | 69 | 20-150 |
| 13C2-6:2FTS | | 87 | 20-150 | M-03 | 70 | 20-150 | H | 69 | 20-150 |
| 13C2-8:2FTS | M-03 | 87 | 20-150 | | 94 | 20-150 | H | 64 | 20-150 |
| 13C2-PFDoA | | 49 | 20-150 | | 50 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | | 27 | 20-150 | | 27 | 20-150 | H | 68 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 | | 91 | 20-150 | H | 71 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 | | 84 | 20-150 | H | 74 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 | | 92 | 20-150 | H | 76 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | | 93 | 20-150 | HN | 17 | 20-150 |
| 13C4-PFHpA | | 88 | 20-150 | | 95 | 20-150 | H | 69 | 20-150 |
| 13C5-PFHxA | | 96 | 20-150 | | 78 | 20-150 | H | 69 | 20-150 |
| 13C5-PFPeA | | 119 | 20-150 | | 93 | 20-150 | H | 72 | 20-150 |
| 13C6-PFDA | | 87 | 20-150 | | 85 | 20-150 | H | 74 | 20-150 |
| 13C7-PFUnA | | 74 | 20-150 | | 65 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOA | | 97 | 20-150 | | 87 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 | | 92 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOSA | | 89 | 20-150 | M-03 | 85 | 20-150 | H | 78 | 20-150 |
| 13C9-PFNA | | 93 | 20-150 | | 83 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 66 | 20-150 | | 60 | 20-150 | H | 70 | 20-150 |
| D3-NMeFOSAA | | 79 | 20-150 | M-03 | 69 | 20-150 | H | 77 | 20-150 |
| D5-NEtFOSA | | 58 | 20-150 | | 55 | 20-150 | H | 69 | 20-150 |
| D5-NEtFOSAA | | 59 | 20-150 | | 55 | 20-150 | H | 78 | 20-150 |
| D7-NMeFOSE | N | 3.0 | 20-150 | N | 3.0 | 20-150 | H | 69 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 66 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-025
Description: VRTB-L-S2_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1703
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1431 | MMM | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 5 | 12/18/2023 1813 | MMM | 11/21/2023 1051 | 90523 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 2102 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.3 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.3 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 12 | JM-03 | 20 | 7.5 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | U | 25 | 23 | 10 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 4.9 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.64 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 52 | QM-03 | 49 | 9.8 | 3.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.8 | UQ | 49 | 9.8 | 3.1 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.4 | U | 9.9 | 6.4 | 2.9 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.4 | U | 9.9 | 5.4 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | U | 9.9 | 3.2 | 0.91 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.4 | U | 9.9 | 6.4 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.1 | | 4.9 | 1.7 | 0.46 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 7.6 | JM-03 | 20 | 8.0 | 2.5 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.81 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.67 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.76 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.53 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 13 | M-03 | 4.9 | 1.9 | 0.94 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 11 | | 4.9 | 3.9 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 140 | | 4.9 | 3.6 | 0.91 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 17 | | 4.9 | 2.0 | 0.70 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.72 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 5.2 | M-03 | 4.9 | 2.0 | 0.51 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.98 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 920 | M-03 | 4.9 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 38 | M-03 | 4.9 | 3.9 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 10 | M-03 | 4.9 | 3.7 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 13 | | 9.9 | 2.0 | 0.91 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | U | 25 | 10 | 2.9 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.96 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-025
Description: VRTB-L-S2_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1703
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 105 | 20-150 | | 84 | 20-150 | H | 69 | 20-150 |
| 13C2-6:2FTS | | 87 | 20-150 | M-03 | 70 | 20-150 | H | 69 | 20-150 |
| 13C2-8:2FTS | M-03 | 87 | 20-150 | | 94 | 20-150 | H | 64 | 20-150 |
| 13C2-PFDoA | | 49 | 20-150 | | 50 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | | 27 | 20-150 | | 27 | 20-150 | H | 68 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 | | 91 | 20-150 | H | 71 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 | | 84 | 20-150 | H | 74 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 | | 92 | 20-150 | H | 76 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | | 93 | 20-150 | HN | 17 | 20-150 |
| 13C4-PFHpA | | 88 | 20-150 | | 95 | 20-150 | H | 69 | 20-150 |
| 13C5-PFHxA | | 96 | 20-150 | | 78 | 20-150 | H | 69 | 20-150 |
| 13C5-PFPeA | | 119 | 20-150 | | 93 | 20-150 | H | 72 | 20-150 |
| 13C6-PFDA | | 87 | 20-150 | | 85 | 20-150 | H | 74 | 20-150 |
| 13C7-PFUnA | | 74 | 20-150 | | 65 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOA | | 97 | 20-150 | | 87 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 | | 92 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOSA | | 89 | 20-150 | M-03 | 85 | 20-150 | H | 78 | 20-150 |
| 13C9-PFNA | | 93 | 20-150 | | 83 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 66 | 20-150 | | 60 | 20-150 | H | 70 | 20-150 |
| D3-NMeFOSAA | | 79 | 20-150 | M-03 | 69 | 20-150 | H | 77 | 20-150 |
| D5-NEtFOSA | | 58 | 20-150 | | 55 | 20-150 | H | 69 | 20-150 |
| D5-NEtFOSAA | | 59 | 20-150 | | 55 | 20-150 | H | 78 | 20-150 |
| D7-NMeFOSE | N | 3.0 | 20-150 | N | 3.0 | 20-150 | H | 69 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 66 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-025
Description: VRTB-L-S2_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1703
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1431 | MMM | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 5 | 12/18/2023 1813 | MMM | 11/21/2023 1051 | 90523 |
| 3 | 1633 | 1633 | 1 | 01/02/2024 2102 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | UH | 20 | 12 | 4.4 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | UH | 20 | 11 | 3.3 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | UH | 20 | 12 | 3.3 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 11 | HJM-03 | 20 | 7.5 | 3.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | UH | 20 | 7.5 | 2.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | UH | 25 | 23 | 10 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | UH | 130 | 52 | 21 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | UH | 20 | 12 | 5.0 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.64 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.5 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | UH | 50 | 10 | 3.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.5 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | UH | 50 | 10 | 3.2 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | UH | 10 | 6.5 | 2.9 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | UH | 10 | 5.5 | 1.8 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | UH | 10 | 3.2 | 0.92 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | UH | 10 | 6.5 | 1.9 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.5 | H | 5.0 | 1.8 | 0.47 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 9.6 | HJQ | 20 | 8.0 | 2.6 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.82 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.68 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.77 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.53 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 14 | HM-03 | 5.0 | 1.9 | 0.95 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 13 | H | 5.0 | 4.0 | 1.1 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | UH | 130 | 52 | 21 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 210 | HM-03 | 5.0 | 3.7 | 0.92 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 19 | H | 5.0 | 2.0 | 0.71 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | UH | 5.0 | 1.9 | 0.73 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 5.9 | HM-03 | 5.0 | 2.0 | 0.52 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.6 | HJM-03 | 5.0 | 2.0 | 0.99 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 990 | HM-03 | 5.0 | 3.7 | 1.2 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 41 | HM-03 | 5.0 | 4.0 | 1.0 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 13 | H | 5.0 | 3.8 | 1.3 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 15 | H | 10 | 2.0 | 0.92 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | UH | 25 | 10 | 3.0 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.3 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.97 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.2 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-025
Description: VRTB-L-S2_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1703
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 105 | 20-150 | | 84 | 20-150 | H | 69 | 20-150 |
| 13C2-6:2FTS | | 87 | 20-150 | M-03 | 70 | 20-150 | H | 69 | 20-150 |
| 13C2-8:2FTS | M-03 | 87 | 20-150 | | 94 | 20-150 | H | 64 | 20-150 |
| 13C2-PFDoA | | 49 | 20-150 | | 50 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | | 27 | 20-150 | | 27 | 20-150 | H | 68 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 | | 91 | 20-150 | H | 71 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 | | 84 | 20-150 | H | 74 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 | | 92 | 20-150 | H | 76 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | | 93 | 20-150 | HN | 17 | 20-150 |
| 13C4-PFHpA | | 88 | 20-150 | | 95 | 20-150 | H | 69 | 20-150 |
| 13C5-PFHxA | | 96 | 20-150 | | 78 | 20-150 | H | 69 | 20-150 |
| 13C5-PFPeA | | 119 | 20-150 | | 93 | 20-150 | H | 72 | 20-150 |
| 13C6-PFDA | | 87 | 20-150 | | 85 | 20-150 | H | 74 | 20-150 |
| 13C7-PFUnA | | 74 | 20-150 | | 65 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOA | | 97 | 20-150 | | 87 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 | | 92 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOSA | | 89 | 20-150 | M-03 | 85 | 20-150 | H | 78 | 20-150 |
| 13C9-PFNA | | 93 | 20-150 | | 83 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 66 | 20-150 | | 60 | 20-150 | H | 70 | 20-150 |
| D3-NMeFOSAA | | 79 | 20-150 | M-03 | 69 | 20-150 | H | 77 | 20-150 |
| D5-NEtFOSA | | 58 | 20-150 | | 55 | 20-150 | H | 69 | 20-150 |
| D5-NEtFOSAA | | 59 | 20-150 | | 55 | 20-150 | H | 78 | 20-150 |
| D7-NMeFOSE | N | 3.0 | 20-150 | N | 3.0 | 20-150 | H | 69 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 66 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-026
Description: VRTB-L-G4_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1749 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1448 | MMM | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 10 | 01/11/2024 0031 | ALM | 12/20/2023 1139 | 92740 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.81 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.62 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 78 | | 3.7 | 1.4 | 0.56 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 67 | | 4.6 | 4.2 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.92 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.2 | 1.8 | 0.56 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.2 | 1.8 | 0.58 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.53 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 8.3 | | 0.92 | 0.32 | 0.087 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 27 | | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.92 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.35 | JM-03 | 0.92 | 0.37 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.92 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.099 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 75 | | 0.92 | 0.35 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 69 | | 0.92 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 590 | EM-03 | 0.92 | 0.67 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 79 | M-03 | 0.92 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.92 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 28 | M-03 | 0.92 | 0.37 | 0.095 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.7 | | 0.92 | 0.37 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 5400 | EM-03 | 0.92 | 0.68 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 140 | | 0.92 | 0.74 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 23 | | 0.92 | 0.69 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 64 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-026
Description: VRTB-L-G4_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1749
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 144 | 20-150 | H | 76 | 20-150 |
| 13C2-6:2FTS | | 131 | 20-150 | HM-03 | 69 | 20-150 |
| 13C2-8:2FTS | | 95 | 20-150 | HM-03 | 63 | 20-150 |
| 13C2-PFDoA | | 67 | 20-150 | H | 52 | 20-150 |
| 13C2-PFTeDA | | 50 | 20-150 | H | 40 | 20-150 |
| 13C3-HFPO-DA | | 93 | 20-150 | H | 79 | 20-150 |
| 13C3-PFBS | | 115 | 20-150 | H | 76 | 20-150 |
| 13C3-PFHxS | | 93 | 20-150 | H | 81 | 20-150 |
| 13C4-PFBA | | 92 | 20-150 | H | 81 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 | H | 79 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 | HM-03 | 77 | 20-150 |
| 13C5-PFPeA | | 108 | 20-150 | H | 78 | 20-150 |
| 13C6-PFDA | | 74 | 20-150 | H | 67 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 | HM-03 | 56 | 20-150 |
| 13C8-PFOA | | 83 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOS | | 85 | 20-150 | H | 80 | 20-150 |
| 13C8-PFOSA | | 135 | 20-150 | H | 79 | 20-150 |
| 13C9-PFNA | | 91 | 20-150 | HM-03 | 75 | 20-150 |
| D3-NMeFOSA | | 112 | 20-150 | H | 53 | 20-150 |
| D3-NMeFOSAA | | 143 | 20-150 | HM-03 | 65 | 20-150 |
| D5-NEtFOSA | | 104 | 20-150 | H | 52 | 20-150 |
| D5-NEtFOSAA | | 104 | 20-150 | HM-03 | 57 | 20-150 |
| D7-NMeFOSE | | 95 | 20-150 | H | 46 | 20-150 |
| D9-NEtFOSE | | 62 | 20-150 | H | 29 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-026
Description: VRTB-L-G4_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1749 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1448 | MMM | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 10 | 01/11/2024 0031 | ALM | 12/20/2023 1139 | 92740 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 22 | UH | 39 | 22 | 8.4 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 21 | UH | 39 | 21 | 6.5 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 22 | UH | 39 | 22 | 6.4 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 86 | HM-03 | 39 | 15 | 5.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 15 | UH | 39 | 15 | 3.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 100 | H | 48 | 44 | 20 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 96 | UH | 240 | 96 | 41 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 23 | UH | 39 | 23 | 9.6 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.9 | UH | 9.7 | 3.9 | 1.2 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.8 | UH | 9.7 | 7.8 | 2.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 19 | UH | 97 | 19 | 5.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.8 | UH | 9.7 | 7.8 | 2.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.8 | UH | 9.7 | 7.8 | 2.8 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 19 | UH | 97 | 19 | 6.1 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 12 | UH | 19 | 12 | 5.6 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 10 | UH | 19 | 10 | 3.5 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 6.1 | UH | 19 | 6.1 | 1.8 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 12 | UH | 19 | 12 | 3.8 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.7 | HM-03 | 9.7 | 3.4 | 0.91 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 30 | HJM-03 | 39 | 16 | 4.9 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.8 | UH | 9.7 | 3.8 | 1.6 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.9 | UH | 9.7 | 3.9 | 1.3 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.8 | UH | 9.7 | 3.8 | 1.5 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.9 | UH | 9.7 | 3.9 | 1.0 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 46 | HM-03 | 9.7 | 3.7 | 1.8 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 76 | H | 9.7 | 7.8 | 2.1 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 96 | UH | 240 | 96 | 40 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 570 | HM-03 | 9.7 | 7.1 | 1.8 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 81 | H | 9.7 | 3.9 | 1.4 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.7 | UH | 9.7 | 3.7 | 1.4 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 30 | HM-03 | 9.7 | 3.9 | 1.0 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | HJM-03 | 9.7 | 3.9 | 1.9 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 4800 | HM-03 | 9.7 | 7.2 | 2.4 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 120 | HM-03 | 9.7 | 7.8 | 2.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 18 | H | 9.7 | 7.3 | 2.5 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 70 | H | 19 | 3.8 | 1.8 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 19 | UH | 48 | 19 | 5.8 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.8 | UH | 9.7 | 7.8 | 2.6 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.9 | UH | 9.7 | 3.9 | 1.9 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.8 | UH | 9.7 | 7.8 | 2.4 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-026
Description: VRTB-L-G4_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1749
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 144 | 20-150 | H | 76 | 20-150 |
| 13C2-6:2FTS | | 131 | 20-150 | HM-03 | 69 | 20-150 |
| 13C2-8:2FTS | | 95 | 20-150 | HM-03 | 63 | 20-150 |
| 13C2-PFDoA | | 67 | 20-150 | H | 52 | 20-150 |
| 13C2-PFTeDA | | 50 | 20-150 | H | 40 | 20-150 |
| 13C3-HFPO-DA | | 93 | 20-150 | H | 79 | 20-150 |
| 13C3-PFBS | | 115 | 20-150 | H | 76 | 20-150 |
| 13C3-PFHxS | | 93 | 20-150 | H | 81 | 20-150 |
| 13C4-PFBA | | 92 | 20-150 | H | 81 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 | H | 79 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 | HM-03 | 77 | 20-150 |
| 13C5-PFPeA | | 108 | 20-150 | H | 78 | 20-150 |
| 13C6-PFDA | | 74 | 20-150 | H | 67 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 | HM-03 | 56 | 20-150 |
| 13C8-PFOA | | 83 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOS | | 85 | 20-150 | H | 80 | 20-150 |
| 13C8-PFOSA | | 135 | 20-150 | H | 79 | 20-150 |
| 13C9-PFNA | | 91 | 20-150 | HM-03 | 75 | 20-150 |
| D3-NMeFOSA | | 112 | 20-150 | H | 53 | 20-150 |
| D3-NMeFOSAA | | 143 | 20-150 | HM-03 | 65 | 20-150 |
| D5-NEtFOSA | | 104 | 20-150 | H | 52 | 20-150 |
| D5-NEtFOSAA | | 104 | 20-150 | HM-03 | 57 | 20-150 |
| D7-NMeFOSE | | 95 | 20-150 | H | 46 | 20-150 |
| D9-NEtFOSE | | 62 | 20-150 | H | 29 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-027
Description: VRTB-L-Y3_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1840 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/15/2023 1504 | MMM | 11/21/2023 1051 | 90523 |
| 2 | 1633 | 1633 | 10 | 12/18/2023 1846 | MMM | 11/21/2023 1051 | 90523 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 140 | | 3.5 | 1.3 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 11 | M-03 | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.2 | | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 9.8 | | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.41 | JM-03 | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 45 | | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 20 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 370 | M-03 | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 26 | M-03 | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.65 | JM-03 | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 18 | | 0.89 | 0.36 | 0.091 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 4.2 | M-03 | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 3100 | M-03 | 8.9 | 6.6 | 2.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 43 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 14 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 21 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-027
Description: VRTB-L-Y3_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1840
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 112 | 20-150 | | 107 | 20-150 |
| 13C2-6:2FTS | | 114 | 20-150 | | 121 | 20-150 |
| 13C2-8:2FTS | | 74 | 20-150 | | 107 | 20-150 |
| 13C2-PFDoA | | 67 | 20-150 | | 70 | 20-150 |
| 13C2-PFTeDA | | 61 | 20-150 | M-03 | 69 | 20-150 |
| 13C3-HFPO-DA | | 99 | 20-150 | | 89 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 | | 99 | 20-150 |
| 13C3-PFHxS | | 78 | 20-150 | | 107 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | | 91 | 20-150 |
| 13C4-PFHpA | | 96 | 20-150 | | 73 | 20-150 |
| 13C5-PFHxA | | 95 | 20-150 | | 71 | 20-150 |
| 13C5-PFPeA | | 113 | 20-150 | | 88 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | | 92 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 | | 93 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 | | 86 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | | 93 | 20-150 |
| 13C8-PFOSA | | 128 | 20-150 | | 93 | 20-150 |
| 13C9-PFNA | | 90 | 20-150 | | 95 | 20-150 |
| D3-NMeFOSA | | 110 | 20-150 | | 71 | 20-150 |
| D3-NMeFOSAA | | 124 | 20-150 | | 92 | 20-150 |
| D5-NEtFOSA | | 103 | 20-150 | | 71 | 20-150 |
| D5-NEtFOSAA | | 98 | 20-150 | | 80 | 20-150 |
| D7-NMeFOSE | | 68 | 20-150 | | 43 | 20-150 |
| D9-NEtFOSE | | 32 | 20-150 | | 21 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-028
Description: VRTB-L-B1_10262023 | Matrix: Aqueous
Date Sampled: 10/26/2023 1925 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 11/30/2023 1506 | BWS | 11/22/2023 1113 | 90629 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.88 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | U | 4.0 | 2.2 | 0.67 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.67 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.9 | J | 4.0 | 1.5 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.40 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.6 | U | 5.0 | 4.6 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.3 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | U | 4.0 | 2.4 | 1.0 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 10 | 2.0 | 0.61 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 10 | 2.0 | 0.63 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.58 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.36 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.19 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.39 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.7 | | 1.0 | 0.35 | 0.094 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 7.0 | | 4.0 | 1.6 | 0.51 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.17 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 12 | M-03 | 1.0 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 7.7 | | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.2 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 140 | | 1.0 | 0.73 | 0.19 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 13 | | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 1.0 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 3.6 | | 1.0 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 540 | | 1.0 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 23 | M-03 | 1.0 | 0.80 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.9 | | 1.0 | 0.75 | 0.26 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 10 | | 2.0 | 0.40 | 0.19 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.1 | JM-03 | 5.0 | 2.0 | 0.60 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-028
Description: VRTB-L-B1_10262023
Matrix: Aqueous
Date Sampled: 10/26/2023 1925
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 106 | 20-150 |
| 13C2-6:2FTS | | 117 | 20-150 |
| 13C2-8:2FTS | | 131 | 20-150 |
| 13C2-PFDoA | | 50 | 20-150 |
| 13C2-PFTeDA | | 32 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 |
| 13C3-PFBS | | 87 | 20-150 |
| 13C3-PFHxS | | 86 | 20-150 |
| 13C4-PFBA | | 86 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 |
| 13C5-PFHxA | | 85 | 20-150 |
| 13C5-PFPeA | | 91 | 20-150 |
| 13C6-PFDA | | 82 | 20-150 |
| 13C7-PFUnA | | 68 | 20-150 |
| 13C8-PFOA | | 99 | 20-150 |
| 13C8-PFOS | | 80 | 20-150 |
| 13C8-PFOSA | | 74 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 |
| D3-NMeFOSA | | 55 | 20-150 |
| D3-NMeFOSAA | | 78 | 20-150 |
| D5-NEtFOSA | | 52 | 20-150 |
| D5-NEtFOSAA | | 60 | 20-150 |
| D7-NMeFOSE | | 45 | 20-150 |
| D9-NEtFOSE | | 36 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-029
Description: DUP-01_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 2019 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1431 | ALM | 11/20/2023 1710 | 90470 |
| 3 | 1633 | 1633 | 10 | 01/03/2024 1353 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.85 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.65 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 26 | M-03 | 3.9 | 1.5 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 39 | | 4.8 | 4.4 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | UM-03 | 24 | 9.6 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.96 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.7 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.7 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.56 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 1.3 | J | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 31 | | 0.97 | 0.34 | 0.091 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 48 | | 3.9 | 1.6 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.28 | J | 0.97 | 0.39 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 160 | M-03 | 0.97 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 89 | | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1400 | EM-03 | 0.97 | 0.71 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 220 | | 0.97 | 0.39 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | JM-03 | 0.97 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 52 | M-03 | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.3 | M-03 | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 13000 | EM-03 | 0.97 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 150 | M-03 | 0.97 | 0.78 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 85 | M-03 | 0.97 | 0.73 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 91 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 0.68 | JM-03 | 4.8 | 1.9 | 0.58 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-029
Description: DUP-01_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | M-03 | 88 | 20-150 | H | 59 | 20-150 |
| 13C2-6:2FTS | M-03 | 94 | 20-150 | M-03 | 70 | 20-150 | H | 67 | 20-150 |
| 13C2-8:2FTS | | 81 | 20-150 | M-03 | 65 | 20-150 | HM-03 | 59 | 20-150 |
| 13C2-PFDoA | | 47 | 20-150 | | 46 | 20-150 | H | 61 | 20-150 |
| 13C2-PFTeDA | | 34 | 20-150 | | 34 | 20-150 | HM-03 | 57 | 20-150 |
| 13C3-HFPO-DA | | 86 | 20-150 | M-03 | 75 | 20-150 | HM-03 | 62 | 20-150 |
| 13C3-PFBS | | 103 | 20-150 | | 85 | 20-150 | H | 63 | 20-150 |
| 13C3-PFHxS | | 81 | 20-150 | | 81 | 20-150 | HM-03 | 62 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 | | 82 | 20-150 | H | 68 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 | | 74 | 20-150 | H | 64 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 | | 77 | 20-150 | H | 62 | 20-150 |
| 13C5-PFPeA | | 83 | 20-150 | | 78 | 20-150 | H | 61 | 20-150 |
| 13C6-PFDA | | 67 | 20-150 | M-03 | 73 | 20-150 | HM-03 | 65 | 20-150 |
| 13C7-PFUnA | | 51 | 20-150 | | 54 | 20-150 | H | 61 | 20-150 |
| 13C8-PFOA | | 84 | 20-150 | | 80 | 20-150 | HM-03 | 55 | 20-150 |
| 13C8-PFOS | | 72 | 20-150 | | 71 | 20-150 | HM-03 | 63 | 20-150 |
| 13C8-PFOSA | | 132 | 20-150 | | 91 | 20-150 | H | 74 | 20-150 |
| 13C9-PFNA | | 73 | 20-150 | | 76 | 20-150 | H | 67 | 20-150 |
| D3-NMeFOSA | | 102 | 20-150 | | 71 | 20-150 | H | 55 | 20-150 |
| D3-NMeFOSAA | | 106 | 20-150 | | 80 | 20-150 | H | 68 | 20-150 |
| D5-NEtFOSA | | 97 | 20-150 | | 67 | 20-150 | H | 57 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 | M-03 | 60 | 20-150 | H | 64 | 20-150 |
| D7-NMeFOSE | | 78 | 20-150 | | 56 | 20-150 | H | 67 | 20-150 |
| D9-NEtFOSE | | 40 | 20-150 | | 28 | 20-150 | H | 65 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-029
Description: DUP-01_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 2019 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1431 | ALM | 11/20/2023 1710 | 90470 |
| 3 | 1633 | 1633 | 10 | 01/03/2024 1353 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.2 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.2 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.2 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 25 | | 19 | 7.1 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 50 | | 24 | 22 | 9.8 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.63 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.6 | U | 48 | 9.6 | 3.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.6 | U | 48 | 9.6 | 3.1 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.3 | U | 9.7 | 6.3 | 2.8 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.3 | U | 9.7 | 5.3 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 1.7 | J | 9.7 | 3.1 | 0.90 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.3 | U | 9.7 | 6.3 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 30 | | 4.8 | 1.7 | 0.45 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 47 | | 19 | 7.6 | 2.5 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.80 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.66 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.75 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.52 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 100 | | 4.8 | 1.8 | 0.92 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 93 | | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1400 | M-03 | 4.8 | 3.5 | 0.89 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 220 | | 4.8 | 1.9 | 0.69 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.8 | U | 4.8 | 1.8 | 0.71 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 47 | | 4.8 | 1.9 | 0.50 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.96 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 14000 | EM-03 | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 150 | M-03 | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 70 | | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 93 | | 9.7 | 1.9 | 0.89 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.9 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.94 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-029
Description: DUP-01_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | M-03 | 88 | 20-150 | H | 59 | 20-150 |
| 13C2-6:2FTS | M-03 | 94 | 20-150 | M-03 | 70 | 20-150 | H | 67 | 20-150 |
| 13C2-8:2FTS | | 81 | 20-150 | M-03 | 65 | 20-150 | HM-03 | 59 | 20-150 |
| 13C2-PFDoA | | 47 | 20-150 | | 46 | 20-150 | H | 61 | 20-150 |
| 13C2-PFTeDA | | 34 | 20-150 | | 34 | 20-150 | HM-03 | 57 | 20-150 |
| 13C3-HFPO-DA | | 86 | 20-150 | M-03 | 75 | 20-150 | HM-03 | 62 | 20-150 |
| 13C3-PFBS | | 103 | 20-150 | | 85 | 20-150 | H | 63 | 20-150 |
| 13C3-PFHxS | | 81 | 20-150 | | 81 | 20-150 | HM-03 | 62 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 | | 82 | 20-150 | H | 68 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 | | 74 | 20-150 | H | 64 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 | | 77 | 20-150 | H | 62 | 20-150 |
| 13C5-PFPeA | | 83 | 20-150 | | 78 | 20-150 | H | 61 | 20-150 |
| 13C6-PFDA | | 67 | 20-150 | M-03 | 73 | 20-150 | HM-03 | 65 | 20-150 |
| 13C7-PFUnA | | 51 | 20-150 | | 54 | 20-150 | H | 61 | 20-150 |
| 13C8-PFOA | | 84 | 20-150 | | 80 | 20-150 | HM-03 | 55 | 20-150 |
| 13C8-PFOS | | 72 | 20-150 | | 71 | 20-150 | HM-03 | 63 | 20-150 |
| 13C8-PFOSA | | 132 | 20-150 | | 91 | 20-150 | H | 74 | 20-150 |
| 13C9-PFNA | | 73 | 20-150 | | 76 | 20-150 | H | 67 | 20-150 |
| D3-NMeFOSA | | 102 | 20-150 | | 71 | 20-150 | H | 55 | 20-150 |
| D3-NMeFOSAA | | 106 | 20-150 | | 80 | 20-150 | H | 68 | 20-150 |
| D5-NEtFOSA | | 97 | 20-150 | | 67 | 20-150 | H | 57 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 | M-03 | 60 | 20-150 | H | 64 | 20-150 |
| D7-NMeFOSE | | 78 | 20-150 | | 56 | 20-150 | H | 67 | 20-150 |
| D9-NEtFOSE | | 40 | 20-150 | | 28 | 20-150 | H | 65 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-029
Description: DUP-01_10242023 | Matrix: Aqueous
Date Sampled: 10/24/2023 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 2019 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1431 | ALM | 11/20/2023 1710 | 90470 |
| 3 | 1633 | 1633 | 10 | 01/03/2024 1353 | ARC2 | 12/18/2023 1345 | 92532 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 75 | UHM-03 | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 230 | UH | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 38 | HJ | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 47 | HJ | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 81 | H | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 100 | HM-03 | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1900 | HM-03 | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 270 | H | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 66 | HM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 14000 | HM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 210 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 78 | H | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 120 | HM-03 | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-029
Description: DUP-01_10242023
Matrix: Aqueous
Date Sampled: 10/24/2023
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | M-03 | 88 | 20-150 | H | 59 | 20-150 |
| 13C2-6:2FTS | M-03 | 94 | 20-150 | M-03 | 70 | 20-150 | H | 67 | 20-150 |
| 13C2-8:2FTS | | 81 | 20-150 | M-03 | 65 | 20-150 | HM-03 | 59 | 20-150 |
| 13C2-PFDoA | | 47 | 20-150 | | 46 | 20-150 | H | 61 | 20-150 |
| 13C2-PFTeDA | | 34 | 20-150 | | 34 | 20-150 | HM-03 | 57 | 20-150 |
| 13C3-HFPO-DA | | 86 | 20-150 | M-03 | 75 | 20-150 | HM-03 | 62 | 20-150 |
| 13C3-PFBS | | 103 | 20-150 | | 85 | 20-150 | H | 63 | 20-150 |
| 13C3-PFHxS | | 81 | 20-150 | | 81 | 20-150 | HM-03 | 62 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 | | 82 | 20-150 | H | 68 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 | | 74 | 20-150 | H | 64 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 | | 77 | 20-150 | H | 62 | 20-150 |
| 13C5-PFPeA | | 83 | 20-150 | | 78 | 20-150 | H | 61 | 20-150 |
| 13C6-PFDA | | 67 | 20-150 | M-03 | 73 | 20-150 | HM-03 | 65 | 20-150 |
| 13C7-PFUnA | | 51 | 20-150 | | 54 | 20-150 | H | 61 | 20-150 |
| 13C8-PFOA | | 84 | 20-150 | | 80 | 20-150 | HM-03 | 55 | 20-150 |
| 13C8-PFOS | | 72 | 20-150 | | 71 | 20-150 | HM-03 | 63 | 20-150 |
| 13C8-PFOSA | | 132 | 20-150 | | 91 | 20-150 | H | 74 | 20-150 |
| 13C9-PFNA | | 73 | 20-150 | | 76 | 20-150 | H | 67 | 20-150 |
| D3-NMeFOSA | | 102 | 20-150 | | 71 | 20-150 | H | 55 | 20-150 |
| D3-NMeFOSAA | | 106 | 20-150 | | 80 | 20-150 | H | 68 | 20-150 |
| D5-NEtFOSA | | 97 | 20-150 | | 67 | 20-150 | H | 57 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 | M-03 | 60 | 20-150 | H | 64 | 20-150 |
| D7-NMeFOSE | | 78 | 20-150 | | 56 | 20-150 | H | 67 | 20-150 |
| D9-NEtFOSE | | 40 | 20-150 | | 28 | 20-150 | H | 65 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: YJ28005-030
Description: DUP-02_10252023 | Matrix: Aqueous
Date Sampled: 10/25/2023 | Project Name: Grayling GWS
Date Received: 10/28/2023 | Project Number: 30027244

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 12/14/2023 2028 | ALM | 11/20/2023 1710 | 90470 |
| 2 | 1633 | 1633 | 5 | 12/15/2023 1440 | ALM | 11/20/2023 1710 | 90470 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.87 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.2 | U | 4.0 | 2.2 | 0.66 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.3 | U | 4.0 | 2.3 | 0.66 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 4.0 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.6 | U | 5.0 | 4.6 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 25 | 10 | 4.3 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.4 | U | 4.0 | 2.4 | 0.98 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 9.9 | 2.0 | 0.60 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 9.9 | 2.0 | 0.63 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.57 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.36 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.39 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 8.5 | | 0.99 | 0.35 | 0.093 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 9.0 | | 4.0 | 1.6 | 0.51 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 0.99 | 0.39 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 24 | M-03 | 0.99 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 8.3 | | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 25 | 10 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 500 | M-03 | 0.99 | 0.72 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 18 | | 0.99 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 0.99 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 2.6 | M-03 | 0.99 | 0.40 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.20 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1100 | M-03 | 5.0 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 15 | M-03 | 0.99 | 0.79 | 0.21 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 22 | | 0.99 | 0.74 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 9.0 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.59 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.27 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 0.99 | 0.40 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.79 | U | 0.99 | 0.79 | 0.25 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: YJ28005-030
Description: DUP-02_10252023
Matrix: Aqueous
Date Sampled: 10/25/2023
Project Name: Grayling GWS
Date Received: 10/28/2023
Project Number: 30027244

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 91 | 20-150 | | 87 | 20-150 |
| 13C2-6:2FTS | | 101 | 20-150 | | 77 | 20-150 |
| 13C2-8:2FTS | | 81 | 20-150 | | 66 | 20-150 |
| 13C2-PFDoA | | 55 | 20-150 | M-03 | 44 | 20-150 |
| 13C2-PFTeDA | | 44 | 20-150 | | 39 | 20-150 |
| 13C3-HFPO-DA | | 80 | 20-150 | | 83 | 20-150 |
| 13C3-PFBS | | 92 | 20-150 | | 85 | 20-150 |
| 13C3-PFHxS | | 77 | 20-150 | | 79 | 20-150 |
| 13C4-PFBA | | 79 | 20-150 | | 79 | 20-150 |
| 13C4-PFHpA | | 79 | 20-150 | | 77 | 20-150 |
| 13C5-PFHxA | | 79 | 20-150 | | 77 | 20-150 |
| 13C5-PFPeA | | 79 | 20-150 | | 80 | 20-150 |
| 13C6-PFDA | | 70 | 20-150 | | 67 | 20-150 |
| 13C7-PFUnA | | 61 | 20-150 | M-03 | 50 | 20-150 |
| 13C8-PFOA | | 83 | 20-150 | | 77 | 20-150 |
| 13C8-PFOS | | 73 | 20-150 | | 76 | 20-150 |
| 13C8-PFOSA | | 71 | 20-150 | | 66 | 20-150 |
| 13C9-PFNA | | 73 | 20-150 | | 71 | 20-150 |
| D3-NMeFOSA | | 59 | 20-150 | | 55 | 20-150 |
| D3-NMeFOSAA | | 67 | 20-150 | | 69 | 20-150 |
| D5-NEtFOSA | | 55 | 20-150 | | 52 | 20-150 |
| D5-NEtFOSAA | | 59 | 20-150 | | 58 | 20-150 |
| D7-NMeFOSE | | 58 | 20-150 | | 52 | 20-150 |
| D9-NEtFOSE | | 42 | 20-150 | | 38 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: YQ90185-001
Batch: 90185
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/16/2023 1218

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 12/13/2023 1551 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 12/13/2023 1551 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 12/13/2023 1551 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 12/13/2023 1551 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 12/13/2023 1551 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 12/13/2023 1551 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 12/13/2023 1551 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 12/13/2023 1551 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 12/13/2023 1551 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 12/13/2023 1551 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 12/13/2023 1551 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 12/13/2023 1551 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 12/13/2023 1551 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 12/13/2023 1551 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 12/13/2023 1551 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 12/13/2023 1551 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 12/13/2023 1551 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 12/13/2023 1551 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 12/13/2023 1551 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 12/13/2023 1551 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 12/13/2023 1551 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 12/13/2023 1551 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 12/13/2023 1551 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 12/13/2023 1551 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 12/13/2023 1551 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 12/13/2023 1551 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 12/13/2023 1551 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 12/13/2023 1551 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 12/13/2023 1551 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 12/13/2023 1551 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 12/13/2023 1551 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 12/13/2023 1551 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 12/13/2023 1551 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 12/13/2023 1551 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 12/13/2023 1551 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 12/13/2023 1551 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 12/13/2023 1551 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 12/13/2023 1551 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 12/13/2023 1551 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 12/13/2023 1551 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 80 | 20-150 |
| 13C2-6:2FTS | | 71 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ90185-001
Batch: 90185
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/16/2023 1218

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 66 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 |
| 13C2-PFTeDA | | 68 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 |
| 13C3-PFBS | | 81 | 20-150 |
| 13C3-PFHxS | | 79 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 |
| 13C4-PFHpA | | 79 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 |
| 13C5-PFPeA | | 80 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 |
| 13C7-PFUnA | | 75 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 |
| 13C8-PFOS | | 69 | 20-150 |
| 13C8-PFOSA | | 72 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 |
| D3-NMeFOSA | | 43 | 20-150 |
| D3-NMeFOSAA | | 72 | 20-150 |
| D5-NEtFOSA | | 42 | 20-150 |
| D5-NEtFOSAA | | 69 | 20-150 |
| D7-NMeFOSE | | 71 | 20-150 |
| D9-NEtFOSE | | 67 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90185-002
Batch: 90185
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/16/2023 1218

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.6 | | 1 | 100 | 40-150 | 12/13/2023 1600 |
| 9Cl-PF3ONS | 7.5 | 7.7 | | 1 | 102 | 40-150 | 12/13/2023 1600 |
| ADONA | 7.6 | 8.4 | | 1 | 111 | 40-150 | 12/13/2023 1600 |
| 8:2FTS | 7.7 | 8.8 | M-03 | 1 | 114 | 40-150 | 12/13/2023 1600 |
| 4:2FTS | 7.5 | 7.8 | | 1 | 104 | 40-150 | 12/13/2023 1600 |
| 6:2FTS | 7.6 | 9.3 | | 1 | 122 | 40-150 | 12/13/2023 1600 |
| 5:3FTCA | 50 | 47 | | 1 | 95 | 40-150 | 12/13/2023 1600 |
| HFPO-DA | 8.0 | 7.1 | | 1 | 89 | 40-150 | 12/13/2023 1600 |
| NEtFOSA | 2.0 | 1.8 | | 1 | 91 | 40-150 | 12/13/2023 1600 |
| NEtFOSAA | 2.0 | 2.0 | M-03 | 1 | 100 | 40-150 | 12/13/2023 1600 |
| NEtFOSE | 20 | 20 | | 1 | 98 | 40-150 | 12/13/2023 1600 |
| NMeFOSA | 2.0 | 1.9 | | 1 | 94 | 40-150 | 12/13/2023 1600 |
| NMeFOSAA | 2.0 | 2.0 | M-03 | 1 | 101 | 40-150 | 12/13/2023 1600 |
| NMeFOSE | 20 | 19 | | 1 | 95 | 40-150 | 12/13/2023 1600 |
| NFDHA | 4.0 | 4.1 | | 1 | 101 | 40-150 | 12/13/2023 1600 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.6 | | 1 | 102 | 40-150 | 12/13/2023 1600 |
| PFMPA | 4.0 | 4.3 | | 1 | 108 | 40-150 | 12/13/2023 1600 |
| PFMBA | 4.0 | 4.2 | | 1 | 105 | 40-150 | 12/13/2023 1600 |
| PFBS | 1.8 | 1.8 | M-03 | 1 | 103 | 40-150 | 12/13/2023 1600 |
| PFBA | 8.0 | 8.0 | | 1 | 100 | 40-150 | 12/13/2023 1600 |
| PFDS | 1.9 | 2.2 | M-03 | 1 | 116 | 40-150 | 12/13/2023 1600 |
| PFDA | 2.0 | 2.1 | | 1 | 106 | 40-150 | 12/13/2023 1600 |
| PFDoS | 1.9 | 1.7 | | 1 | 88 | 40-150 | 12/13/2023 1600 |
| PFDoA | 2.0 | 2.0 | | 1 | 101 | 40-150 | 12/13/2023 1600 |
| PFHpS | 1.9 | 2.2 | | 1 | 116 | 40-150 | 12/13/2023 1600 |
| PFHpA | 2.0 | 1.9 | M-03 | 1 | 93 | 40-150 | 12/13/2023 1600 |
| 7:3FTCA | 50 | 36 | M-03 | 1 | 71 | 40-150 | 12/13/2023 1600 |
| PFHxS | 1.8 | 2.0 | M-03 | 1 | 109 | 40-150 | 12/13/2023 1600 |
| PFHxA | 2.0 | 2.0 | M-03 | 1 | 98 | 40-150 | 12/13/2023 1600 |
| PFNS | 1.9 | 2.1 | | 1 | 111 | 40-150 | 12/13/2023 1600 |
| PFNA | 2.0 | 2.0 | | 1 | 99 | 40-150 | 12/13/2023 1600 |
| PFOSA | 2.0 | 2.0 | | 1 | 100 | 40-150 | 12/13/2023 1600 |
| PFOS | 1.9 | 1.9 | M-03 | 1 | 103 | 40-150 | 12/13/2023 1600 |
| PFOA | 2.0 | 2.0 | | 1 | 99 | 40-150 | 12/13/2023 1600 |
| PFPeS | 1.9 | 1.8 | | 1 | 96 | 40-150 | 12/13/2023 1600 |
| PFPeA | 4.0 | 3.9 | | 1 | 98 | 40-150 | 12/13/2023 1600 |
| 3:3FTCA | 10 | 9.6 | | 1 | 96 | 40-150 | 12/13/2023 1600 |
| PFTeDA | 2.0 | 2.0 | | 1 | 100 | 40-150 | 12/13/2023 1600 |
| PFTrDA | 2.0 | 2.0 | | 1 | 98 | 40-150 | 12/13/2023 1600 |
| PFUnA | 2.0 | 1.7 | | 1 | 84 | 40-150 | 12/13/2023 1600 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 81 | 20-150 |
| 13C2-6:2FTS | | 78 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90185-002
Batch: 90185
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/16/2023 1218

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 76 | 20-150 |
| 13C2-PFDoA | | 82 | 20-150 |
| 13C2-PFTeDA | | 64 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 |
| 13C3-PFBS | | 78 | 20-150 |
| 13C3-PFHxS | | 78 | 20-150 |
| 13C4-PFBA | | 86 | 20-150 |
| 13C4-PFHpA | | 80 | 20-150 |
| 13C5-PFHxA | | 87 | 20-150 |
| 13C5-PFPeA | | 83 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 |
| 13C7-PFUnA | | 90 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 |
| 13C8-PFOS | | 80 | 20-150 |
| 13C8-PFOSA | | 83 | 20-150 |
| 13C9-PFNA | | 82 | 20-150 |
| D3-NMeFOSA | | 47 | 20-150 |
| D3-NMeFOSAA | | 80 | 20-150 |
| D5-NEtFOSA | | 45 | 20-150 |
| D5-NEtFOSAA | | 80 | 20-150 |
| D7-NMeFOSE | | 78 | 20-150 |
| D9-NEtFOSE | | 73 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90185-102
Batch: 90185
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/16/2023 1218

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 78 | | 1 | 86 | 40-150 | 12/13/2023 1609 |
| 9Cl-PF3ONS | 90 | 77 | | 1 | 86 | 40-150 | 12/13/2023 1609 |
| ADONA | 91 | 85 | | 1 | 93 | 40-150 | 12/13/2023 1609 |
| 8:2FTS | 92 | 87 | | 1 | 95 | 40-150 | 12/13/2023 1609 |
| 4:2FTS | 90 | 73 | | 1 | 81 | 40-150 | 12/13/2023 1609 |
| 6:2FTS | 91 | 79 | | 1 | 87 | 40-150 | 12/13/2023 1609 |
| 5:3FTCA | 600 | 500 | | 1 | 83 | 40-150 | 12/13/2023 1609 |
| HFPO-DA | 96 | 83 | | 1 | 86 | 40-150 | 12/13/2023 1609 |
| NEtFOSA | 24 | 21 | | 1 | 87 | 40-150 | 12/13/2023 1609 |
| NEtFOSAA | 24 | 21 | M-03 | 1 | 89 | 40-150 | 12/13/2023 1609 |
| NEtFOSE | 240 | 220 | | 1 | 90 | 40-150 | 12/13/2023 1609 |
| NMeFOSA | 24 | 21 | | 1 | 87 | 40-150 | 12/13/2023 1609 |
| NMeFOSAA | 24 | 21 | M-03 | 1 | 87 | 40-150 | 12/13/2023 1609 |
| NMeFOSE | 240 | 200 | | 1 | 83 | 40-150 | 12/13/2023 1609 |
| NFDHA | 48 | 41 | | 1 | 86 | 40-150 | 12/13/2023 1609 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 39 | | 1 | 92 | 40-150 | 12/13/2023 1609 |
| PFMPA | 48 | 45 | | 1 | 93 | 40-150 | 12/13/2023 1609 |
| PFMBA | 48 | 44 | | 1 | 91 | 40-150 | 12/13/2023 1609 |
| PFBS | 21 | 19 | | 1 | 89 | 40-150 | 12/13/2023 1609 |
| PFBA | 96 | 84 | | 1 | 88 | 40-150 | 12/13/2023 1609 |
| PFDS | 23 | 22 | | 1 | 96 | 40-150 | 12/13/2023 1609 |
| PFDA | 24 | 21 | | 1 | 88 | 40-150 | 12/13/2023 1609 |
| PFDoS | 23 | 19 | | 1 | 83 | 40-150 | 12/13/2023 1609 |
| PFDoA | 24 | 21 | | 1 | 89 | 40-150 | 12/13/2023 1609 |
| PFHpS | 23 | 25 | | 1 | 108 | 40-150 | 12/13/2023 1609 |
| PFHpA | 24 | 21 | | 1 | 88 | 40-150 | 12/13/2023 1609 |
| 7:3FTCA | 600 | 380 | | 1 | 63 | 40-150 | 12/13/2023 1609 |
| PFHxS | 22 | 18 | M-03 | 1 | 84 | 40-150 | 12/13/2023 1609 |
| PFHxA | 24 | 21 | | 1 | 87 | 40-150 | 12/13/2023 1609 |
| PFNS | 23 | 23 | | 1 | 100 | 40-150 | 12/13/2023 1609 |
| PFNA | 24 | 20 | | 1 | 83 | 40-150 | 12/13/2023 1609 |
| PFOSA | 24 | 20 | | 1 | 84 | 40-150 | 12/13/2023 1609 |
| PFOS | 22 | 20 | M-03 | 1 | 89 | 40-150 | 12/13/2023 1609 |
| PFOA | 24 | 19 | | 1 | 81 | 40-150 | 12/13/2023 1609 |
| PFPeS | 23 | 20 | | 1 | 87 | 40-150 | 12/13/2023 1609 |
| PFPeA | 48 | 41 | | 1 | 85 | 40-150 | 12/13/2023 1609 |
| 3:3FTCA | 120 | 100 | | 1 | 85 | 40-150 | 12/13/2023 1609 |
| PFTeDA | 24 | 20 | | 1 | 85 | 40-150 | 12/13/2023 1609 |
| PFTrDA | 24 | 19 | | 1 | 79 | 40-150 | 12/13/2023 1609 |
| PFUnA | 24 | 20 | | 1 | 84 | 40-150 | 12/13/2023 1609 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 87 | 20-150 |
| 13C2-6:2FTS | | 83 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90185-102
Batch: 90185
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/16/2023 1218

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 79 | 20-150 |
| 13C2-PFDoA | | 86 | 20-150 |
| 13C2-PFTeDA | | 72 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 |
| 13C3-PFBS | | 88 | 20-150 |
| 13C3-PFHxS | | 86 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 |
| 13C6-PFDA | | 87 | 20-150 |
| 13C7-PFUnA | | 86 | 20-150 |
| 13C8-PFOA | | 93 | 20-150 |
| 13C8-PFOS | | 71 | 20-150 |
| 13C8-PFOSA | | 77 | 20-150 |
| 13C9-PFNA | | 83 | 20-150 |
| D3-NMeFOSA | | 44 | 20-150 |
| D3-NMeFOSAA | | 74 | 20-150 |
| D5-NEtFOSA | | 42 | 20-150 |
| D5-NEtFOSAA | | 72 | 20-150 |
| D7-NMeFOSE | | 75 | 20-150 |
| D9-NEtFOSE | | 68 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: YJ28005-004MS
Batch: 90185
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/16/2023 1218

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 88 | 80 | | 1 | 91 | 40-150 | 12/13/2023 1655 |
| 9Cl-PF3ONS | ND | 87 | 87 | | 1 | 99 | 40-150 | 12/13/2023 1655 |
| ADONA | ND | 88 | 90 | | 1 | 102 | 40-150 | 12/13/2023 1655 |
| 8:2FTS | ND | 90 | 99 | | 1 | 110 | 40-150 | 12/13/2023 1655 |
| 4:2FTS | ND | 87 | 80 | | 1 | 91 | 40-150 | 12/13/2023 1655 |
| 6:2FTS | ND | 89 | 84 | | 1 | 95 | 40-150 | 12/13/2023 1655 |
| 5:3FTCA | ND | 580 | 530 | | 1 | 90 | 40-150 | 12/13/2023 1655 |
| HFPO-DA | ND | 93 | 95 | | 1 | 102 | 40-150 | 12/13/2023 1655 |
| NEtFOSA | ND | 23 | 21 | | 1 | 90 | 40-150 | 12/13/2023 1655 |
| NEtFOSAA | ND | 23 | 21 | | 1 | 89 | 40-150 | 12/13/2023 1655 |
| NEtFOSE | ND | 230 | 230 | | 1 | 98 | 40-150 | 12/13/2023 1655 |
| NMeFOSA | ND | 23 | 22 | | 1 | 94 | 40-150 | 12/13/2023 1655 |
| NMeFOSAA | ND | 23 | 21 | M-03 | 1 | 89 | 40-150 | 12/13/2023 1655 |
| NMeFOSE | ND | 230 | 210 | | 1 | 92 | 40-150 | 12/13/2023 1655 |
| NFDHA | ND | 47 | 44 | | 1 | 94 | 40-150 | 12/13/2023 1655 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 41 | 41 | | 1 | 98 | 40-150 | 12/13/2023 1655 |
| PFMPA | ND | 47 | 48 | | 1 | 103 | 40-150 | 12/13/2023 1655 |
| PFMBA | ND | 47 | 48 | | 1 | 102 | 40-150 | 12/13/2023 1655 |
| PFBS | 8.2 | 21 | 28 | | 1 | 94 | 40-150 | 12/13/2023 1655 |
| PFBA | 10 | 93 | 96 | | 1 | 92 | 40-150 | 12/13/2023 1655 |
| PFDS | ND | 22 | 20 | | 1 | 91 | 40-150 | 12/13/2023 1655 |
| PFDA | ND | 23 | 23 | | 1 | 99 | 40-150 | 12/13/2023 1655 |
| PFDoS | ND | 23 | 21 | | 1 | 92 | 40-150 | 12/13/2023 1655 |
| PFDoA | ND | 23 | 23 | | 1 | 99 | 40-150 | 12/13/2023 1655 |
| PFHpS | 8.1 | 22 | 31 | | 1 | 104 | 40-150 | 12/13/2023 1655 |
| PFHpA | 10 | 23 | 30 | | 1 | 84 | 40-150 | 12/13/2023 1655 |
| 7:3FTCA | ND | 580 | 450 | | 1 | 78 | 40-150 | 12/13/2023 1655 |
| PFHxS | 130 | 21 | 160 | M-03 | 1 | 129 | 40-150 | 12/13/2023 1655 |
| PFHxA | 15 | 23 | 36 | | 1 | 90 | 40-150 | 12/13/2023 1655 |
| PFNS | ND | 22 | 23 | | 1 | 102 | 40-150 | 12/13/2023 1655 |
| PFNA | 1.7 | 23 | 26 | | 1 | 106 | 40-150 | 12/13/2023 1655 |
| PFOSA | ND | 23 | 22 | | 1 | 93 | 40-150 | 12/13/2023 1655 |
| PFOS | 280 | 22 | 280 | NM-03 | 1 | -2.0 | 40-150 | 12/13/2023 1655 |
| PFOA | 16 | 23 | 38 | M-03 | 1 | 96 | 40-150 | 12/13/2023 1655 |
| PFPeS | 11 | 22 | 32 | | 1 | 97 | 40-150 | 12/13/2023 1655 |
| PFPeA | 12 | 47 | 55 | | 1 | 91 | 40-150 | 12/13/2023 1655 |
| 3:3FTCA | ND | 120 | 110 | | 1 | 95 | 40-150 | 12/13/2023 1655 |
| PFTeDA | ND | 23 | 22 | | 1 | 95 | 40-150 | 12/13/2023 1655 |
| PFTrDA | ND | 23 | 22 | | 1 | 95 | 40-150 | 12/13/2023 1655 |
| PFUnA | ND | 23 | 21 | | 1 | 92 | 40-150 | 12/13/2023 1655 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 88 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: YJ28005-004MS
Batch: 90185
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/16/2023 1218

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 78 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 |
| 13C2-PFTeDA | | 77 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 |
| 13C3-PFBS | | 92 | 20-150 |
| 13C3-PFHxS | | 87 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 |
| 13C4-PFHpA | | 87 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 |
| 13C7-PFUnA | | 77 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 |
| 13C8-PFOS | | 90 | 20-150 |
| 13C8-PFOSA | | 93 | 20-150 |
| 13C9-PFNA | | 72 | 20-150 |
| D3-NMeFOSA | | 58 | 20-150 |
| D3-NMeFOSAA | | 85 | 20-150 |
| D5-NEtFOSA | | 62 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 |
| D7-NMeFOSE | | 82 | 20-150 |
| D9-NEtFOSE | | 76 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: YJ28005-004MD
Batch: 90185
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/16/2023 1218

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 87 | 73 | | 1 | 83 | 9.1 | 40-150 | 30 | 12/13/2023 1704 |
| 9Cl-PF3ONS | ND | 86 | 79 | | 1 | 91 | 9.3 | 40-150 | 30 | 12/13/2023 1704 |
| ADONA | ND | 87 | 84 | | 1 | 96 | 7.2 | 40-150 | 30 | 12/13/2023 1704 |
| 8:2FTS | ND | 89 | 94 | | 1 | 106 | 4.5 | 40-150 | 30 | 12/13/2023 1704 |
| 4:2FTS | ND | 87 | 80 | | 1 | 93 | 0.35 | 40-150 | 30 | 12/13/2023 1704 |
| 6:2FTS | ND | 88 | 84 | | 1 | 95 | 0.20 | 40-150 | 30 | 12/13/2023 1704 |
| 5:3FTCA | ND | 580 | 510 | | 1 | 89 | 2.2 | 40-150 | 30 | 12/13/2023 1704 |
| HFPO-DA | ND | 92 | 85 | | 1 | 92 | 11 | 40-150 | 30 | 12/13/2023 1704 |
| NEtFOSA | ND | 23 | 21 | | 1 | 89 | 1.9 | 40-150 | 30 | 12/13/2023 1704 |
| NEtFOSAA | ND | 23 | 17 | | 1 | 75 | 18 | 40-150 | 30 | 12/13/2023 1704 |
| NEtFOSE | ND | 230 | 210 | | 1 | 89 | 9.5 | 40-150 | 30 | 12/13/2023 1704 |
| NMeFOSA | ND | 23 | 21 | | 1 | 91 | 3.5 | 40-150 | 30 | 12/13/2023 1704 |
| NMeFOSAA | ND | 23 | 19 | | 1 | 82 | 9.2 | 40-150 | 30 | 12/13/2023 1704 |
| NMeFOSE | ND | 230 | 200 | | 1 | 87 | 6.9 | 40-150 | 30 | 12/13/2023 1704 |
| NFDHA | ND | 46 | 42 | | 1 | 90 | 5.4 | 40-150 | 30 | 12/13/2023 1704 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 41 | 40 | | 1 | 97 | 1.8 | 40-150 | 30 | 12/13/2023 1704 |
| PFMPA | ND | 46 | 44 | | 1 | 95 | 8.3 | 40-150 | 30 | 12/13/2023 1704 |
| PFMBA | ND | 46 | 43 | | 1 | 93 | 10 | 40-150 | 30 | 12/13/2023 1704 |
| PFBS | 8.2 | 21 | 26 | | 1 | 88 | 5.1 | 40-150 | 30 | 12/13/2023 1704 |
| PFBA | 10 | 92 | 93 | | 1 | 90 | 3.1 | 40-150 | 30 | 12/13/2023 1704 |
| PFDS | ND | 22 | 20 | | 1 | 91 | 0.86 | 40-150 | 30 | 12/13/2023 1704 |
| PFDA | ND | 23 | 21 | | 1 | 91 | 10 | 40-150 | 30 | 12/13/2023 1704 |
| PFDoS | ND | 22 | 19 | | 1 | 86 | 7.4 | 40-150 | 30 | 12/13/2023 1704 |
| PFDoA | ND | 23 | 21 | | 1 | 90 | 11 | 40-150 | 30 | 12/13/2023 1704 |
| PFHpS | 8.1 | 22 | 29 | | 1 | 97 | 5.5 | 40-150 | 30 | 12/13/2023 1704 |
| PFHpA | 10 | 23 | 33 | | 1 | 99 | 11 | 40-150 | 30 | 12/13/2023 1704 |
| 7:3FTCA | ND | 580 | 410 | | 1 | 70 | 11 | 40-150 | 30 | 12/13/2023 1704 |
| PFHxS | 130 | 21 | 160 | M-03 | 1 | 133 | 0.34 | 40-150 | 30 | 12/13/2023 1704 |
| PFHxA | 15 | 23 | 35 | | 1 | 88 | 2.1 | 40-150 | 30 | 12/13/2023 1704 |
| PFNS | ND | 22 | 21 | | 1 | 96 | 6.7 | 40-150 | 30 | 12/13/2023 1704 |
| PFNA | 1.7 | 23 | 22 | | 1 | 88 | 18 | 40-150 | 30 | 12/13/2023 1704 |
| PFOSA | ND | 23 | 20 | | 1 | 87 | 7.5 | 40-150 | 30 | 12/13/2023 1704 |
| PFOS | 280 | 21 | 290 | NM-03 | 1 | 25 | 2.0 | 40-150 | 30 | 12/13/2023 1704 |
| PFOA | 16 | 23 | 40 | M-03 | 1 | 105 | 4.9 | 40-150 | 30 | 12/13/2023 1704 |
| PFPeS | 11 | 22 | 29 | | 1 | 86 | 8.4 | 40-150 | 30 | 12/13/2023 1704 |
| PFPeA | 12 | 46 | 53 | | 1 | 87 | 4.3 | 40-150 | 30 | 12/13/2023 1704 |
| 3:3FTCA | ND | 120 | 95 | | 1 | 82 | 15 | 40-150 | 30 | 12/13/2023 1704 |
| PFTeDA | ND | 23 | 21 | | 1 | 93 | 2.8 | 40-150 | 30 | 12/13/2023 1704 |
| PFTrDA | ND | 23 | 21 | | 1 | 89 | 7.4 | 40-150 | 30 | 12/13/2023 1704 |
| PFUnA | ND | 23 | 19 | | 1 | 81 | 13 | 40-150 | 30 | 12/13/2023 1704 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 78 | 20-150 |
| 13C2-6:2FTS | | 74 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: YJ28005-004MD
Batch: 90185
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/16/2023 1218

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 66 | 20-150 |
| 13C2-PFDoA | | 69 | 20-150 |
| 13C2-PFTeDA | | 66 | 20-150 |
| 13C3-HFPO-DA | | 74 | 20-150 |
| 13C3-PFBS | | 84 | 20-150 |
| 13C3-PFHxS | | 78 | 20-150 |
| 13C4-PFBA | | 76 | 20-150 |
| 13C4-PFHpA | | 66 | 20-150 |
| 13C5-PFHxA | | 74 | 20-150 |
| 13C5-PFPeA | | 74 | 20-150 |
| 13C6-PFDA | | 75 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 |
| 13C8-PFOA | | 77 | 20-150 |
| 13C8-PFOS | | 73 | 20-150 |
| 13C8-PFOSA | | 76 | 20-150 |
| 13C9-PFNA | | 75 | 20-150 |
| D3-NMeFOSA | | 49 | 20-150 |
| D3-NMeFOSAA | | 69 | 20-150 |
| D5-NEtFOSA | | 49 | 20-150 |
| D5-NEtFOSAA | M-03 | 68 | 20-150 |
| D7-NMeFOSE | | 59 | 20-150 |
| D9-NEtFOSE | | 54 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ90470-001
Batch: 90470
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/20/2023 1710

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 12/14/2023 1639 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 12/14/2023 1639 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 12/14/2023 1639 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 12/14/2023 1639 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 12/14/2023 1639 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 12/14/2023 1639 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 12/14/2023 1639 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 12/14/2023 1639 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 12/14/2023 1639 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 12/14/2023 1639 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 12/14/2023 1639 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 12/14/2023 1639 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 12/14/2023 1639 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 12/14/2023 1639 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 12/14/2023 1639 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 12/14/2023 1639 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 12/14/2023 1639 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 12/14/2023 1639 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 12/14/2023 1639 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 12/14/2023 1639 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 12/14/2023 1639 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 12/14/2023 1639 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 12/14/2023 1639 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 12/14/2023 1639 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 12/14/2023 1639 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 12/14/2023 1639 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 12/14/2023 1639 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 12/14/2023 1639 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 12/14/2023 1639 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 12/14/2023 1639 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 12/14/2023 1639 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 12/14/2023 1639 |
| PFOS | 0.74 | UM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 12/14/2023 1639 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 12/14/2023 1639 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 12/14/2023 1639 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 12/14/2023 1639 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 12/14/2023 1639 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 12/14/2023 1639 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 12/14/2023 1639 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 12/14/2023 1639 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 81 | 20-150 |
| 13C2-6:2FTS | | 80 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ90470-001
Batch: 90470
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/20/2023 1710

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 71 | 20-150 |
| 13C2-PFDoA | | 68 | 20-150 |
| 13C2-PFTeDA | | 67 | 20-150 |
| 13C3-HFPO-DA | | 80 | 20-150 |
| 13C3-PFBS | | 83 | 20-150 |
| 13C3-PFHxS | | 77 | 20-150 |
| 13C4-PFBA | | 79 | 20-150 |
| 13C4-PFHpA | | 75 | 20-150 |
| 13C5-PFHxA | | 77 | 20-150 |
| 13C5-PFPeA | | 76 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 |
| 13C8-PFOA | | 83 | 20-150 |
| 13C8-PFOS | | 79 | 20-150 |
| 13C8-PFOSA | | 75 | 20-150 |
| 13C9-PFNA | | 77 | 20-150 |
| D3-NMeFOSA | | 56 | 20-150 |
| D3-NMeFOSAA | | 80 | 20-150 |
| D5-NEtFOSA | | 59 | 20-150 |
| D5-NEtFOSAA | | 71 | 20-150 |
| D7-NMeFOSE | | 76 | 20-150 |
| D9-NEtFOSE | | 71 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90470-002
Batch: 90470
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/20/2023 1710

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.8 | | 1 | 103 | 40-150 | 12/15/2023 1327 |
| 9Cl-PF3ONS | 7.5 | 8.4 | | 1 | 112 | 40-150 | 12/15/2023 1327 |
| ADONA | 7.6 | 9.6 | | 1 | 127 | 40-150 | 12/15/2023 1327 |
| 8:2FTS | 7.7 | 8.5 | | 1 | 111 | 40-150 | 12/15/2023 1327 |
| 4:2FTS | 7.5 | 8.7 | | 1 | 115 | 40-150 | 12/15/2023 1327 |
| 6:2FTS | 7.6 | 10 | | 1 | 138 | 40-150 | 12/15/2023 1327 |
| 5:3FTCA | 50 | 62 | | 1 | 123 | 40-150 | 12/15/2023 1327 |
| HFPO-DA | 8.0 | 8.8 | | 1 | 110 | 40-150 | 12/15/2023 1327 |
| NEtFOSA | 2.0 | 1.9 | M-03 | 1 | 97 | 40-150 | 12/15/2023 1327 |
| NEtFOSAA | 2.0 | 2.4 | M-03 | 1 | 121 | 40-150 | 12/15/2023 1327 |
| NEtFOSE | 20 | 23 | | 1 | 116 | 40-150 | 12/15/2023 1327 |
| NMeFOSA | 2.0 | 2.2 | | 1 | 112 | 40-150 | 12/15/2023 1327 |
| NMeFOSAA | 2.0 | 2.6 | M-03 | 1 | 128 | 40-150 | 12/15/2023 1327 |
| NMeFOSE | 20 | 22 | | 1 | 108 | 40-150 | 12/15/2023 1327 |
| NFDHA | 4.0 | 4.8 | | 1 | 120 | 40-150 | 12/15/2023 1327 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.3 | | 1 | 121 | 40-150 | 12/15/2023 1327 |
| PFMPA | 4.0 | 5.0 | | 1 | 126 | 40-150 | 12/15/2023 1327 |
| PFMBA | 4.0 | 4.8 | | 1 | 119 | 40-150 | 12/15/2023 1327 |
| PFBS | 1.8 | 2.2 | | 1 | 125 | 40-150 | 12/15/2023 1327 |
| PFBA | 8.0 | 9.5 | | 1 | 119 | 40-150 | 12/15/2023 1327 |
| PFDS | 1.9 | 2.2 | | 1 | 114 | 40-150 | 12/15/2023 1327 |
| PFDA | 2.0 | 2.2 | | 1 | 109 | 40-150 | 12/15/2023 1327 |
| PFDoS | 1.9 | 1.9 | | 1 | 97 | 40-150 | 12/15/2023 1327 |
| PFDoA | 2.0 | 2.3 | M-03 | 1 | 114 | 40-150 | 12/15/2023 1327 |
| PFHpS | 1.9 | 2.5 | M-03 | 1 | 130 | 40-150 | 12/15/2023 1327 |
| PFHpA | 2.0 | 2.3 | | 1 | 116 | 40-150 | 12/15/2023 1327 |
| 7:3FTCA | 50 | 56 | | 1 | 113 | 40-150 | 12/15/2023 1327 |
| PFHxS | 1.8 | 2.4 | M-03 | 1 | 131 | 40-150 | 12/15/2023 1327 |
| PFHxA | 2.0 | 2.3 | | 1 | 115 | 40-150 | 12/15/2023 1327 |
| PFNS | 1.9 | 2.2 | | 1 | 115 | 40-150 | 12/15/2023 1327 |
| PFNA | 2.0 | 2.3 | M-03 | 1 | 116 | 40-150 | 12/15/2023 1327 |
| PFOSA | 2.0 | 2.4 | | 1 | 118 | 40-150 | 12/15/2023 1327 |
| PFOS | 1.9 | 2.3 | M-03 | 1 | 126 | 40-150 | 12/15/2023 1327 |
| PFOA | 2.0 | 2.5 | M-03 | 1 | 125 | 40-150 | 12/15/2023 1327 |
| PFPeS | 1.9 | 2.4 | M-03 | 1 | 126 | 40-150 | 12/15/2023 1327 |
| PFPeA | 4.0 | 4.7 | | 1 | 117 | 40-150 | 12/15/2023 1327 |
| 3:3FTCA | 10 | 11 | | 1 | 113 | 40-150 | 12/15/2023 1327 |
| PFTeDA | 2.0 | 2.3 | M-03 | 1 | 114 | 40-150 | 12/15/2023 1327 |
| PFTrDA | 2.0 | 1.9 | M-03 | 1 | 97 | 40-150 | 12/15/2023 1327 |
| PFUnA | 2.0 | 2.5 | M-03 | 1 | 125 | 40-150 | 12/15/2023 1327 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90470-002
Batch: 90470
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/20/2023 1710

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 76 | 20-150 |
| 13C2-PFDoA | | 72 | 20-150 |
| 13C2-PFTeDA | | 65 | 20-150 |
| 13C3-HFPO-DA | | 79 | 20-150 |
| 13C3-PFBS | | 83 | 20-150 |
| 13C3-PFHxS | | 76 | 20-150 |
| 13C4-PFBA | | 79 | 20-150 |
| 13C4-PFHpA | | 80 | 20-150 |
| 13C5-PFHxA | | 78 | 20-150 |
| 13C5-PFPeA | | 80 | 20-150 |
| 13C6-PFDA | | 76 | 20-150 |
| 13C7-PFUnA | | 70 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 |
| 13C8-PFOS | | 74 | 20-150 |
| 13C8-PFOSA | | 77 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 |
| D3-NMeFOSA | | 58 | 20-150 |
| D3-NMeFOSAA | | 77 | 20-150 |
| D5-NEtFOSA | | 59 | 20-150 |
| D5-NEtFOSAA | | 79 | 20-150 |
| D7-NMeFOSE | | 78 | 20-150 |
| D9-NEtFOSE | | 74 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90470-102
Batch: 90470
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/20/2023 1710

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 79 | | 1 | 87 | 40-150 | 12/15/2023 1336 |
| 9Cl-PF3ONS | 90 | 87 | | 1 | 97 | 40-150 | 12/15/2023 1336 |
| ADONA | 91 | 96 | | 1 | 105 | 40-150 | 12/15/2023 1336 |
| 8:2FTS | 92 | 88 | | 1 | 95 | 40-150 | 12/15/2023 1336 |
| 4:2FTS | 90 | 86 | | 1 | 96 | 40-150 | 12/15/2023 1336 |
| 6:2FTS | 91 | 87 | | 1 | 95 | 40-150 | 12/15/2023 1336 |
| 5:3FTCA | 600 | 660 | | 1 | 110 | 40-150 | 12/15/2023 1336 |
| HFPO-DA | 96 | 99 | | 1 | 103 | 40-150 | 12/15/2023 1336 |
| NEtFOSA | 24 | 23 | | 1 | 95 | 40-150 | 12/15/2023 1336 |
| NEtFOSAA | 24 | 24 | M-03 | 1 | 99 | 40-150 | 12/15/2023 1336 |
| NEtFOSE | 240 | 230 | | 1 | 97 | 40-150 | 12/15/2023 1336 |
| NMeFOSA | 24 | 23 | | 1 | 96 | 40-150 | 12/15/2023 1336 |
| NMeFOSAA | 24 | 24 | M-03 | 1 | 99 | 40-150 | 12/15/2023 1336 |
| NMeFOSE | 240 | 230 | | 1 | 94 | 40-150 | 12/15/2023 1336 |
| NFDHA | 48 | 63 | | 1 | 131 | 40-150 | 12/15/2023 1336 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 57 | | 1 | 134 | 40-150 | 12/15/2023 1336 |
| PFMPA | 48 | 61 | | 1 | 127 | 40-150 | 12/15/2023 1336 |
| PFMBA | 48 | 60 | | 1 | 126 | 40-150 | 12/15/2023 1336 |
| PFBS | 21 | 21 | | 1 | 98 | 40-150 | 12/15/2023 1336 |
| PFBA | 96 | 95 | | 1 | 99 | 40-150 | 12/15/2023 1336 |
| PFDS | 23 | 22 | | 1 | 93 | 40-150 | 12/15/2023 1336 |
| PFDA | 24 | 23 | | 1 | 96 | 40-150 | 12/15/2023 1336 |
| PFDoS | 23 | 20 | | 1 | 87 | 40-150 | 12/15/2023 1336 |
| PFDoA | 24 | 23 | | 1 | 97 | 40-150 | 12/15/2023 1336 |
| PFHpS | 23 | 26 | | 1 | 112 | 40-150 | 12/15/2023 1336 |
| PFHpA | 24 | 23 | | 1 | 97 | 40-150 | 12/15/2023 1336 |
| 7:3FTCA | 600 | 550 | | 1 | 92 | 40-150 | 12/15/2023 1336 |
| PFHxS | 22 | 21 | M-03 | 1 | 95 | 40-150 | 12/15/2023 1336 |
| PFHxA | 24 | 24 | | 1 | 98 | 40-150 | 12/15/2023 1336 |
| PFNS | 23 | 25 | | 1 | 106 | 40-150 | 12/15/2023 1336 |
| PFNA | 24 | 24 | | 1 | 102 | 40-150 | 12/15/2023 1336 |
| PFOSA | 24 | 23 | | 1 | 96 | 40-150 | 12/15/2023 1336 |
| PFOS | 22 | 23 | M-03 | 1 | 104 | 40-150 | 12/15/2023 1336 |
| PFOA | 24 | 23 | | 1 | 97 | 40-150 | 12/15/2023 1336 |
| PFPeS | 23 | 22 | | 1 | 98 | 40-150 | 12/15/2023 1336 |
| PFPeA | 48 | 47 | | 1 | 98 | 40-150 | 12/15/2023 1336 |
| 3:3FTCA | 120 | 130 | | 1 | 110 | 40-150 | 12/15/2023 1336 |
| PFTeDA | 24 | 25 | | 1 | 104 | 40-150 | 12/15/2023 1336 |
| PFTrDA | 24 | 22 | | 1 | 90 | 40-150 | 12/15/2023 1336 |
| PFUnA | 24 | 23 | | 1 | 97 | 40-150 | 12/15/2023 1336 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 80 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90470-102
Batch: 90470
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/20/2023 1710

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 78 | 20-150 |
| 13C2-PFDoA | | 67 | 20-150 |
| 13C2-PFTeDA | | 66 | 20-150 |
| 13C3-HFPO-DA | | 76 | 20-150 |
| 13C3-PFBS | | 77 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 |
| 13C4-PFBA | | 77 | 20-150 |
| 13C4-PFHpA | | 78 | 20-150 |
| 13C5-PFHxA | | 77 | 20-150 |
| 13C5-PFPeA | | 76 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 |
| 13C7-PFUnA | | 69 | 20-150 |
| 13C8-PFOA | | 83 | 20-150 |
| 13C8-PFOS | | 72 | 20-150 |
| 13C8-PFOSA | | 72 | 20-150 |
| 13C9-PFNA | | 70 | 20-150 |
| D3-NMeFOSA | | 46 | 20-150 |
| D3-NMeFOSAA | | 76 | 20-150 |
| D5-NEtFOSA | | 45 | 20-150 |
| D5-NEtFOSAA | | 73 | 20-150 |
| D7-NMeFOSE | | 73 | 20-150 |
| D9-NEtFOSE | | 68 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ90523-001
Batch: 90523
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/21/2023 1051

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 12/15/2023 0801 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 12/15/2023 0801 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 12/15/2023 0801 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 12/15/2023 0801 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 12/15/2023 0801 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 12/15/2023 0801 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 12/15/2023 0801 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 12/15/2023 0801 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 12/15/2023 0801 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 12/15/2023 0801 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 12/15/2023 0801 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 12/15/2023 0801 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 12/15/2023 0801 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 12/15/2023 0801 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 12/15/2023 0801 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 12/15/2023 0801 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 12/15/2023 0801 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 12/15/2023 0801 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 12/15/2023 0801 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 12/15/2023 0801 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 12/15/2023 0801 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 12/15/2023 0801 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 12/15/2023 0801 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 12/15/2023 0801 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 12/15/2023 0801 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 12/15/2023 0801 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 12/15/2023 0801 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 12/15/2023 0801 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 12/15/2023 0801 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 12/15/2023 0801 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 12/15/2023 0801 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 12/15/2023 0801 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 12/15/2023 0801 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 12/15/2023 0801 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 12/15/2023 0801 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 12/15/2023 0801 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 12/15/2023 0801 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 12/15/2023 0801 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 12/15/2023 0801 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 12/15/2023 0801 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 103 | 20-150 |
| 13C2-6:2FTS | | 105 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ90523-001
Batch: 90523
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/21/2023 1051

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 84 | 20-150 |
| 13C2-PFDoA | | 86 | 20-150 |
| 13C2-PFTeDA | | 87 | 20-150 |
| 13C3-HFPO-DA | | 97 | 20-150 |
| 13C3-PFBS | | 107 | 20-150 |
| 13C3-PFHxS | | 94 | 20-150 |
| 13C4-PFBA | | 96 | 20-150 |
| 13C4-PFHpA | | 88 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 |
| 13C5-PFPeA | | 110 | 20-150 |
| 13C6-PFDA | | 95 | 20-150 |
| 13C7-PFUnA | | 91 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 |
| 13C8-PFOS | | 98 | 20-150 |
| 13C8-PFOSA | | 104 | 20-150 |
| 13C9-PFNA | | 80 | 20-150 |
| D3-NMeFOSA | | 69 | 20-150 |
| D3-NMeFOSAA | | 104 | 20-150 |
| D5-NEtFOSA | | 73 | 20-150 |
| D5-NEtFOSAA | | 90 | 20-150 |
| D7-NMeFOSE | | 93 | 20-150 |
| D9-NEtFOSE | | 92 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90523-002
Batch: 90523
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/21/2023 1051

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.4 | | 1 | 97 | 40-150 | 12/15/2023 0817 |
| 9Cl-PF3ONS | 7.5 | 7.8 | | 1 | 104 | 40-150 | 12/15/2023 0817 |
| ADONA | 7.6 | 10 | | 1 | 137 | 40-150 | 12/15/2023 0817 |
| 8:2FTS | 7.7 | 9.2 | | 1 | 120 | 40-150 | 12/15/2023 0817 |
| 4:2FTS | 7.5 | 8.6 | | 1 | 115 | 40-150 | 12/15/2023 0817 |
| 6:2FTS | 7.6 | 9.8 | | 1 | 128 | 40-150 | 12/15/2023 0817 |
| 5:3FTCA | 50 | 54 | | 1 | 109 | 40-150 | 12/15/2023 0817 |
| HFPO-DA | 8.0 | 8.1 | | 1 | 102 | 40-150 | 12/15/2023 0817 |
| NEtFOSA | 2.0 | 2.1 | | 1 | 106 | 40-150 | 12/15/2023 0817 |
| NEtFOSAA | 2.0 | 2.0 | M-03 | 1 | 100 | 40-150 | 12/15/2023 0817 |
| NEtFOSE | 20 | 23 | | 1 | 115 | 40-150 | 12/15/2023 0817 |
| NMeFOSA | 2.0 | 2.2 | M-03 | 1 | 111 | 40-150 | 12/15/2023 0817 |
| NMeFOSAA | 2.0 | 2.1 | | 1 | 106 | 40-150 | 12/15/2023 0817 |
| NMeFOSE | 20 | 23 | | 1 | 116 | 40-150 | 12/15/2023 0817 |
| NFDHA | 4.0 | 4.4 | | 1 | 109 | 40-150 | 12/15/2023 0817 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.3 | | 1 | 122 | 40-150 | 12/15/2023 0817 |
| PFMPA | 4.0 | 3.6 | M-03 | 1 | 90 | 40-150 | 12/15/2023 0817 |
| PFMBA | 4.0 | 4.1 | | 1 | 102 | 40-150 | 12/15/2023 0817 |
| PFBS | 1.8 | 2.2 | | 1 | 122 | 40-150 | 12/15/2023 0817 |
| PFBA | 8.0 | 9.3 | M-08 | 1 | 116 | 40-150 | 12/15/2023 0817 |
| PFDS | 1.9 | 1.9 | | 1 | 99 | 40-150 | 12/15/2023 0817 |
| PFDA | 2.0 | 2.3 | M-03 | 1 | 114 | 40-150 | 12/15/2023 0817 |
| PFDoS | 1.9 | 1.9 | | 1 | 97 | 40-150 | 12/15/2023 0817 |
| PFDoA | 2.0 | 2.4 | | 1 | 118 | 40-150 | 12/15/2023 0817 |
| PFHpS | 1.9 | 2.4 | | 1 | 125 | 40-150 | 12/15/2023 0817 |
| PFHpA | 2.0 | 2.2 | | 1 | 111 | 40-150 | 12/15/2023 0817 |
| 7:3FTCA | 50 | 45 | M-03 | 1 | 91 | 40-150 | 12/15/2023 0817 |
| PFHxS | 1.8 | 2.2 | M-03 | 1 | 118 | 40-150 | 12/15/2023 0817 |
| PFHxA | 2.0 | 2.4 | | 1 | 119 | 40-150 | 12/15/2023 0817 |
| PFNS | 1.9 | 2.1 | | 1 | 112 | 40-150 | 12/15/2023 0817 |
| PFNA | 2.0 | 2.2 | | 1 | 110 | 40-150 | 12/15/2023 0817 |
| PFOSA | 2.0 | 2.3 | M-03 | 1 | 117 | 40-150 | 12/15/2023 0817 |
| PFOS | 1.9 | 2.2 | M-03 | 1 | 118 | 40-150 | 12/15/2023 0817 |
| PFOA | 2.0 | 2.1 | M-03 | 1 | 103 | 40-150 | 12/15/2023 0817 |
| PFPeS | 1.9 | 2.1 | | 1 | 111 | 40-150 | 12/15/2023 0817 |
| PFPeA | 4.0 | 4.4 | | 1 | 110 | 40-150 | 12/15/2023 0817 |
| 3:3FTCA | 10 | 8.6 | | 1 | 86 | 40-150 | 12/15/2023 0817 |
| PFTeDA | 2.0 | 2.3 | M-03 | 1 | 117 | 40-150 | 12/15/2023 0817 |
| PFTrDA | 2.0 | 2.4 | | 1 | 120 | 40-150 | 12/15/2023 0817 |
| PFUnA | 2.0 | 2.3 | | 1 | 115 | 40-150 | 12/15/2023 0817 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 95 | 20-150 |
| 13C2-6:2FTS | | 100 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90523-002
Batch: 90523
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/21/2023 1051

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 84 | 20-150 |
| 13C2-PFDoA | | 83 | 20-150 |
| 13C2-PFTeDA | | 84 | 20-150 |
| 13C3-HFPO-DA | | 101 | 20-150 |
| 13C3-PFBS | | 93 | 20-150 |
| 13C3-PFHxS | | 91 | 20-150 |
| 13C4-PFBA | M-08 | 91 | 20-150 |
| 13C4-PFHpA | | 91 | 20-150 |
| 13C5-PFHxA | | 92 | 20-150 |
| 13C5-PFPeA | | 115 | 20-150 |
| 13C6-PFDA | | 99 | 20-150 |
| 13C7-PFUnA | | 89 | 20-150 |
| 13C8-PFOA | | 86 | 20-150 |
| 13C8-PFOS | | 87 | 20-150 |
| 13C8-PFOSA | | 93 | 20-150 |
| 13C9-PFNA | | 93 | 20-150 |
| D3-NMeFOSA | | 51 | 20-150 |
| D3-NMeFOSAA | | 93 | 20-150 |
| D5-NEtFOSA | | 54 | 20-150 |
| D5-NEtFOSAA | | 79 | 20-150 |
| D7-NMeFOSE | | 79 | 20-150 |
| D9-NEtFOSE | | 79 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90523-102
Batch: 90523
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/21/2023 1051

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 69 | | 1 | 76 | 40-150 | 12/15/2023 0834 |
| 9Cl-PF3ONS | 90 | 75 | | 1 | 84 | 40-150 | 12/15/2023 0834 |
| ADONA | 91 | 76 | | 1 | 84 | 40-150 | 12/15/2023 0834 |
| 8:2FTS | 92 | 92 | | 1 | 100 | 40-150 | 12/15/2023 0834 |
| 4:2FTS | 90 | 86 | | 1 | 95 | 40-150 | 12/15/2023 0834 |
| 6:2FTS | 91 | 81 | | 1 | 89 | 40-150 | 12/15/2023 0834 |
| 5:3FTCA | 600 | 530 | | 1 | 89 | 40-150 | 12/15/2023 0834 |
| HFPO-DA | 96 | 79 | | 1 | 83 | 40-150 | 12/15/2023 0834 |
| NEtFOSA | 24 | 22 | | 1 | 91 | 40-150 | 12/15/2023 0834 |
| NEtFOSAA | 24 | 23 | M-03 | 1 | 95 | 40-150 | 12/15/2023 0834 |
| NEtFOSE | 240 | 230 | | 1 | 94 | 40-150 | 12/15/2023 0834 |
| NMeFOSA | 24 | 21 | | 1 | 88 | 40-150 | 12/15/2023 0834 |
| NMeFOSAA | 24 | 21 | M-03 | 1 | 89 | 40-150 | 12/15/2023 0834 |
| NMeFOSE | 240 | 210 | | 1 | 89 | 40-150 | 12/15/2023 0834 |
| NFDHA | 48 | 51 | | 1 | 107 | 40-150 | 12/15/2023 0834 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 44 | | 1 | 103 | 40-150 | 12/15/2023 0834 |
| PFMPA | 48 | 33 | | 1 | 69 | 40-150 | 12/15/2023 0834 |
| PFMBA | 48 | 39 | | 1 | 81 | 40-150 | 12/15/2023 0834 |
| PFBS | 21 | 21 | | 1 | 99 | 40-150 | 12/15/2023 0834 |
| PFBA | 96 | 89 | | 1 | 93 | 40-150 | 12/15/2023 0834 |
| PFDS | 23 | 19 | | 1 | 83 | 40-150 | 12/15/2023 0834 |
| PFDA | 24 | 20 | | 1 | 84 | 40-150 | 12/15/2023 0834 |
| PFDoS | 23 | 19 | | 1 | 80 | 40-150 | 12/15/2023 0834 |
| PFDoA | 24 | 21 | | 1 | 89 | 40-150 | 12/15/2023 0834 |
| PFHpS | 23 | 21 | | 1 | 92 | 40-150 | 12/15/2023 0834 |
| PFHpA | 24 | 21 | | 1 | 87 | 40-150 | 12/15/2023 0834 |
| 7:3FTCA | 600 | 520 | | 1 | 87 | 40-150 | 12/15/2023 0834 |
| PFHxS | 22 | 18 | | 1 | 84 | 40-150 | 12/15/2023 0834 |
| PFHxA | 24 | 21 | | 1 | 88 | 40-150 | 12/15/2023 0834 |
| PFNS | 23 | 21 | | 1 | 91 | 40-150 | 12/15/2023 0834 |
| PFNA | 24 | 22 | | 1 | 91 | 40-150 | 12/15/2023 0834 |
| PFOSA | 24 | 21 | | 1 | 86 | 40-150 | 12/15/2023 0834 |
| PFOS | 22 | 20 | M-03 | 1 | 88 | 40-150 | 12/15/2023 0834 |
| PFOA | 24 | 20 | | 1 | 81 | 40-150 | 12/15/2023 0834 |
| PFPeS | 23 | 21 | | 1 | 91 | 40-150 | 12/15/2023 0834 |
| PFPeA | 48 | 45 | | 1 | 95 | 40-150 | 12/15/2023 0834 |
| 3:3FTCA | 120 | 89 | | 1 | 74 | 40-150 | 12/15/2023 0834 |
| PFTeDA | 24 | 23 | | 1 | 96 | 40-150 | 12/15/2023 0834 |
| PFTrDA | 24 | 22 | | 1 | 91 | 40-150 | 12/15/2023 0834 |
| PFUnA | 24 | 23 | | 1 | 95 | 40-150 | 12/15/2023 0834 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 88 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90523-102
Batch: 90523
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/21/2023 1051

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 82 | 20-150 |
| 13C2-PFDoA | | 85 | 20-150 |
| 13C2-PFTeDA | | 80 | 20-150 |
| 13C3-HFPO-DA | | 103 | 20-150 |
| 13C3-PFBS | | 92 | 20-150 |
| 13C3-PFHxS | | 93 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 |
| 13C5-PFPeA | | 112 | 20-150 |
| 13C6-PFDA | | 95 | 20-150 |
| 13C7-PFUnA | | 82 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 |
| 13C8-PFOS | | 95 | 20-150 |
| 13C8-PFOSA | | 92 | 20-150 |
| 13C9-PFNA | | 95 | 20-150 |
| D3-NMeFOSA | | 60 | 20-150 |
| D3-NMeFOSAA | | 91 | 20-150 |
| D5-NEtFOSA | | 63 | 20-150 |
| D5-NEtFOSAA | | 78 | 20-150 |
| D7-NMeFOSE | | 83 | 20-150 |
| D9-NEtFOSE | | 80 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ90629-001
Batch: 90629
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/22/2023 1113

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 11/30/2023 1237 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 11/30/2023 1237 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 11/30/2023 1237 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 11/30/2023 1237 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 11/30/2023 1237 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 11/30/2023 1237 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 11/30/2023 1237 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 11/30/2023 1237 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 11/30/2023 1237 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 11/30/2023 1237 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 11/30/2023 1237 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 11/30/2023 1237 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 11/30/2023 1237 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 11/30/2023 1237 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 11/30/2023 1237 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 11/30/2023 1237 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 11/30/2023 1237 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 11/30/2023 1237 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 11/30/2023 1237 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 11/30/2023 1237 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 11/30/2023 1237 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 11/30/2023 1237 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 11/30/2023 1237 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 11/30/2023 1237 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 11/30/2023 1237 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 11/30/2023 1237 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 11/30/2023 1237 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 11/30/2023 1237 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 11/30/2023 1237 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 11/30/2023 1237 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 11/30/2023 1237 |
| PFOSA | 0.40 | UM-03 | 1 | 1.0 | 0.40 | 0.20 | ng/L | 11/30/2023 1237 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 11/30/2023 1237 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 11/30/2023 1237 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 11/30/2023 1237 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 11/30/2023 1237 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 11/30/2023 1237 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 11/30/2023 1237 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 11/30/2023 1237 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 11/30/2023 1237 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 98 | 20-150 |
| 13C2-6:2FTS | | 97 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ90629-001
Batch: 90629
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/22/2023 1113

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | N | 160 | 20-150 |
| 13C2-PFDoA | | 93 | 20-150 |
| 13C2-PFTeDA | | 88 | 20-150 |
| 13C3-HFPO-DA | | 94 | 20-150 |
| 13C3-PFBS | | 96 | 20-150 |
| 13C3-PFHxS | | 95 | 20-150 |
| 13C4-PFBA | M-03 | 91 | 20-150 |
| 13C4-PFHpA | | 89 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 |
| 13C5-PFPeA | | 93 | 20-150 |
| 13C6-PFDA | | 96 | 20-150 |
| 13C7-PFUnA | | 96 | 20-150 |
| 13C8-PFOA | | 93 | 20-150 |
| 13C8-PFOS | | 91 | 20-150 |
| 13C8-PFOSA | | 85 | 20-150 |
| 13C9-PFNA | | 90 | 20-150 |
| D3-NMeFOSA | | 69 | 20-150 |
| D3-NMeFOSAA | | 95 | 20-150 |
| D5-NEtFOSA | | 74 | 20-150 |
| D5-NEtFOSAA | | 92 | 20-150 |
| D7-NMeFOSE | | 92 | 20-150 |
| D9-NEtFOSE | | 89 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90629-002
Batch: 90629
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/22/2023 1113

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.6 | | 1 | 100 | 40-150 | 11/30/2023 1255 |
| 9Cl-PF3ONS | 7.5 | 8.3 | | 1 | 111 | 40-150 | 11/30/2023 1255 |
| ADONA | 7.6 | 8.1 | | 1 | 107 | 40-150 | 11/30/2023 1255 |
| 8:2FTS | 7.7 | 7.7 | | 1 | 100 | 40-150 | 11/30/2023 1255 |
| 4:2FTS | 7.5 | 7.1 | | 1 | 95 | 40-150 | 11/30/2023 1255 |
| 6:2FTS | 7.6 | 7.4 | | 1 | 97 | 40-150 | 11/30/2023 1255 |
| 5:3FTCA | 50 | 48 | | 1 | 96 | 40-150 | 11/30/2023 1255 |
| HFPO-DA | 8.0 | 7.9 | | 1 | 99 | 40-150 | 11/30/2023 1255 |
| NEtFOSA | 2.0 | 1.8 | | 1 | 89 | 40-150 | 11/30/2023 1255 |
| NEtFOSAA | 2.0 | 1.7 | M-03 | 1 | 84 | 40-150 | 11/30/2023 1255 |
| NEtFOSE | 20 | 19 | | 1 | 96 | 40-150 | 11/30/2023 1255 |
| NMeFOSA | 2.0 | 1.8 | M-03 | 1 | 89 | 40-150 | 11/30/2023 1255 |
| NMeFOSAA | 2.0 | 2.0 | | 1 | 99 | 40-150 | 11/30/2023 1255 |
| NMeFOSE | 20 | 19 | | 1 | 94 | 40-150 | 11/30/2023 1255 |
| NFDHA | 4.0 | 3.3 | | 1 | 83 | 40-150 | 11/30/2023 1255 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 2.8 | | 1 | 78 | 40-150 | 11/30/2023 1255 |
| PFMPA | 4.0 | 3.5 | | 1 | 87 | 40-150 | 11/30/2023 1255 |
| PFMBA | 4.0 | 3.7 | | 1 | 93 | 40-150 | 11/30/2023 1255 |
| PFBS | 1.8 | 1.8 | | 1 | 102 | 40-150 | 11/30/2023 1255 |
| PFBA | 8.0 | 7.6 | | 1 | 95 | 40-150 | 11/30/2023 1255 |
| PFDS | 1.9 | 1.8 | | 1 | 93 | 40-150 | 11/30/2023 1255 |
| PFDA | 2.0 | 2.0 | | 1 | 101 | 40-150 | 11/30/2023 1255 |
| PFDoS | 1.9 | 1.8 | | 1 | 92 | 40-150 | 11/30/2023 1255 |
| PFDoA | 2.0 | 2.0 | | 1 | 100 | 40-150 | 11/30/2023 1255 |
| PFHpS | 1.9 | 1.7 | | 1 | 91 | 40-150 | 11/30/2023 1255 |
| PFHpA | 2.0 | 1.9 | | 1 | 93 | 40-150 | 11/30/2023 1255 |
| 7:3FTCA | 50 | 39 | | 1 | 78 | 40-150 | 11/30/2023 1255 |
| PFHxS | 1.8 | 1.7 | M-03 | 1 | 91 | 40-150 | 11/30/2023 1255 |
| PFHxA | 2.0 | 1.9 | | 1 | 96 | 40-150 | 11/30/2023 1255 |
| PFNS | 1.9 | 1.8 | | 1 | 96 | 40-150 | 11/30/2023 1255 |
| PFNA | 2.0 | 2.0 | | 1 | 99 | 40-150 | 11/30/2023 1255 |
| PFOSA | 2.0 | 1.8 | | 1 | 92 | 40-150 | 11/30/2023 1255 |
| PFOS | 1.9 | 1.8 | | 1 | 96 | 40-150 | 11/30/2023 1255 |
| PFOA | 2.0 | 1.9 | M-03 | 1 | 96 | 40-150 | 11/30/2023 1255 |
| PFPeS | 1.9 | 1.8 | | 1 | 98 | 40-150 | 11/30/2023 1255 |
| PFPeA | 4.0 | 3.8 | M-03 | 1 | 94 | 40-150 | 11/30/2023 1255 |
| 3:3FTCA | 10 | 10 | | 1 | 103 | 40-150 | 11/30/2023 1255 |
| PFTeDA | 2.0 | 1.7 | | 1 | 87 | 40-150 | 11/30/2023 1255 |
| PFTrDA | 2.0 | 1.8 | | 1 | 90 | 40-150 | 11/30/2023 1255 |
| PFUnA | 2.0 | 1.6 | | 1 | 80 | 40-150 | 11/30/2023 1255 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 91 | 20-150 |
| 13C2-6:2FTS | | 97 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90629-002
Batch: 90629
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/22/2023 1113

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | N | 167 | 20-150 |
| 13C2-PFDoA | | 90 | 20-150 |
| 13C2-PFTeDA | | 90 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 |
| 13C3-PFBS | | 88 | 20-150 |
| 13C3-PFHxS | | 93 | 20-150 |
| 13C4-PFBA | | 92 | 20-150 |
| 13C4-PFHpA | | 88 | 20-150 |
| 13C5-PFHxA | | 92 | 20-150 |
| 13C5-PFPeA | | 92 | 20-150 |
| 13C6-PFDA | | 94 | 20-150 |
| 13C7-PFUnA | | 94 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 |
| 13C8-PFOS | | 92 | 20-150 |
| 13C8-PFOSA | | 85 | 20-150 |
| 13C9-PFNA | | 91 | 20-150 |
| D3-NMeFOSA | | 68 | 20-150 |
| D3-NMeFOSAA | | 90 | 20-150 |
| D5-NEtFOSA | | 75 | 20-150 |
| D5-NEtFOSAA | | 87 | 20-150 |
| D7-NMeFOSE | | 86 | 20-150 |
| D9-NEtFOSE | | 87 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90629-102
Batch: 90629
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/22/2023 1113

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 100 | | 1 | 114 | 40-150 | 11/30/2023 1314 |
| 9Cl-PF3ONS | 90 | 110 | | 1 | 118 | 40-150 | 11/30/2023 1314 |
| ADONA | 91 | 99 | | 1 | 109 | 40-150 | 11/30/2023 1314 |
| 8:2FTS | 92 | 98 | | 1 | 106 | 40-150 | 11/30/2023 1314 |
| 4:2FTS | 90 | 88 | | 1 | 98 | 40-150 | 11/30/2023 1314 |
| 6:2FTS | 91 | 89 | | 1 | 98 | 40-150 | 11/30/2023 1314 |
| 5:3FTCA | 600 | 610 | | 1 | 102 | 40-150 | 11/30/2023 1314 |
| HFPO-DA | 96 | 100 | | 1 | 107 | 40-150 | 11/30/2023 1314 |
| NEtFOSA | 24 | 23 | | 1 | 96 | 40-150 | 11/30/2023 1314 |
| NEtFOSAA | 24 | 25 | | 1 | 103 | 40-150 | 11/30/2023 1314 |
| NEtFOSE | 240 | 250 | | 1 | 105 | 40-150 | 11/30/2023 1314 |
| NMeFOSA | 24 | 23 | | 1 | 97 | 40-150 | 11/30/2023 1314 |
| NMeFOSAA | 24 | 24 | | 1 | 100 | 40-150 | 11/30/2023 1314 |
| NMeFOSE | 240 | 250 | | 1 | 104 | 40-150 | 11/30/2023 1314 |
| NFDHA | 48 | 46 | | 1 | 96 | 40-150 | 11/30/2023 1314 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 41 | | 1 | 95 | 40-150 | 11/30/2023 1314 |
| PFMPA | 48 | 46 | | 1 | 96 | 40-150 | 11/30/2023 1314 |
| PFMBA | 48 | 49 | | 1 | 102 | 40-150 | 11/30/2023 1314 |
| PFBS | 21 | 21 | | 1 | 97 | 40-150 | 11/30/2023 1314 |
| PFBA | 96 | 94 | | 1 | 98 | 40-150 | 11/30/2023 1314 |
| PFDS | 23 | 22 | | 1 | 94 | 40-150 | 11/30/2023 1314 |
| PFDA | 24 | 22 | | 1 | 91 | 40-150 | 11/30/2023 1314 |
| PFDoS | 23 | 22 | | 1 | 95 | 40-150 | 11/30/2023 1314 |
| PFDoA | 24 | 22 | | 1 | 92 | 40-150 | 11/30/2023 1314 |
| PFHpS | 23 | 24 | | 1 | 104 | 40-150 | 11/30/2023 1314 |
| PFHpA | 24 | 23 | | 1 | 98 | 40-150 | 11/30/2023 1314 |
| 7:3FTCA | 600 | 520 | | 1 | 86 | 40-150 | 11/30/2023 1314 |
| PFHxS | 22 | 21 | | 1 | 94 | 40-150 | 11/30/2023 1314 |
| PFHxA | 24 | 25 | | 1 | 103 | 40-150 | 11/30/2023 1314 |
| PFNS | 23 | 23 | | 1 | 99 | 40-150 | 11/30/2023 1314 |
| PFNA | 24 | 24 | | 1 | 99 | 40-150 | 11/30/2023 1314 |
| PFOSA | 24 | 24 | | 1 | 99 | 40-150 | 11/30/2023 1314 |
| PFOS | 22 | 22 | M-03 | 1 | 99 | 40-150 | 11/30/2023 1314 |
| PFOA | 24 | 24 | | 1 | 99 | 40-150 | 11/30/2023 1314 |
| PFPeS | 23 | 23 | | 1 | 102 | 40-150 | 11/30/2023 1314 |
| PFPeA | 48 | 46 | | 1 | 97 | 40-150 | 11/30/2023 1314 |
| 3:3FTCA | 120 | 120 | | 1 | 98 | 40-150 | 11/30/2023 1314 |
| PFTeDA | 24 | 23 | | 1 | 95 | 40-150 | 11/30/2023 1314 |
| PFTrDA | 24 | 20 | | 1 | 85 | 40-150 | 11/30/2023 1314 |
| PFUnA | 24 | 23 | | 1 | 94 | 40-150 | 11/30/2023 1314 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 88 | 20-150 |
| 13C2-6:2FTS | | 90 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ90629-102
Batch: 90629
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 11/22/2023 1113

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | N | 151 | 20-150 |
| 13C2-PFDoA | | 87 | 20-150 |
| 13C2-PFTeDA | | 81 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 |
| 13C3-PFBS | | 88 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 |
| 13C4-PFHpA | | 90 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 |
| 13C5-PFPeA | | 92 | 20-150 |
| 13C6-PFDA | | 91 | 20-150 |
| 13C7-PFUnA | | 86 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 |
| 13C8-PFOS | | 89 | 20-150 |
| 13C8-PFOSA | | 81 | 20-150 |
| 13C9-PFNA | | 95 | 20-150 |
| D3-NMeFOSA | | 54 | 20-150 |
| D3-NMeFOSAA | | 90 | 20-150 |
| D5-NEtFOSA | | 59 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 |
| D7-NMeFOSE | | 81 | 20-150 |
| D9-NEtFOSE | | 78 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ92532-001
Batch: 92532
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/18/2023 1345

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 01/02/2024 1808 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 01/02/2024 1808 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 01/02/2024 1808 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 01/02/2024 1808 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 01/02/2024 1808 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 01/02/2024 1808 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 01/02/2024 1808 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 01/02/2024 1808 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 01/02/2024 1808 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 01/02/2024 1808 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 01/02/2024 1808 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 01/02/2024 1808 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 01/02/2024 1808 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 01/02/2024 1808 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 01/02/2024 1808 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 01/02/2024 1808 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 01/02/2024 1808 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 01/02/2024 1808 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 01/02/2024 1808 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 01/02/2024 1808 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 01/02/2024 1808 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 01/02/2024 1808 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 01/02/2024 1808 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 01/02/2024 1808 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 01/02/2024 1808 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 01/02/2024 1808 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 01/02/2024 1808 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 01/02/2024 1808 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 01/02/2024 1808 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 01/02/2024 1808 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 01/02/2024 1808 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 01/02/2024 1808 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 01/02/2024 1808 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 01/02/2024 1808 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 01/02/2024 1808 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 01/02/2024 1808 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 01/02/2024 1808 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 01/02/2024 1808 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 01/02/2024 1808 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 01/02/2024 1808 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 55 | 20-150 |
| 13C2-6:2FTS | | 56 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ92532-001
Batch: 92532
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/18/2023 1345

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 55 | 20-150 |
| 13C2-PFDoA | | 55 | 20-150 |
| 13C2-PFTeDA | | 59 | 20-150 |
| 13C3-HFPO-DA | | 63 | 20-150 |
| 13C3-PFBS | | 70 | 20-150 |
| 13C3-PFHxS | | 57 | 20-150 |
| 13C4-PFBA | | 62 | 20-150 |
| 13C4-PFHpA | | 63 | 20-150 |
| 13C5-PFHxA | | 63 | 20-150 |
| 13C5-PFPeA | | 66 | 20-150 |
| 13C6-PFDA | | 59 | 20-150 |
| 13C7-PFUnA | | 61 | 20-150 |
| 13C8-PFOA | | 65 | 20-150 |
| 13C8-PFOS | | 63 | 20-150 |
| 13C8-PFOSA | | 62 | 20-150 |
| 13C9-PFNA | | 65 | 20-150 |
| D3-NMeFOSA | | 41 | 20-150 |
| D3-NMeFOSAA | | 63 | 20-150 |
| D5-NEtFOSA | | 41 | 20-150 |
| D5-NEtFOSAA | | 67 | 20-150 |
| D7-NMeFOSE | | 59 | 20-150 |
| D9-NEtFOSE | | 55 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92532-002
Batch: 92532
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/18/2023 1345

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 110 | | 1 | 117 | 40-150 | 01/02/2024 1817 |
| 9Cl-PF3ONS | 90 | 110 | | 1 | 123 | 40-150 | 01/02/2024 1817 |
| ADONA | 91 | 110 | | 1 | 122 | 40-150 | 01/02/2024 1817 |
| 8:2FTS | 92 | 96 | | 1 | 104 | 40-150 | 01/02/2024 1817 |
| 4:2FTS | 90 | 110 | | 1 | 126 | 40-150 | 01/02/2024 1817 |
| 6:2FTS | 91 | 110 | | 1 | 125 | 40-150 | 01/02/2024 1817 |
| 5:3FTCA | 600 | 660 | | 1 | 110 | 40-150 | 01/02/2024 1817 |
| HFPO-DA | 96 | 110 | | 1 | 114 | 40-150 | 01/02/2024 1817 |
| NEtFOSA | 24 | 29 | | 1 | 122 | 40-150 | 01/02/2024 1817 |
| NEtFOSAA | 24 | 25 | | 1 | 102 | 40-150 | 01/02/2024 1817 |
| NEtFOSE | 240 | 280 | | 1 | 115 | 40-150 | 01/02/2024 1817 |
| NMeFOSA | 24 | 29 | | 1 | 121 | 40-150 | 01/02/2024 1817 |
| NMeFOSAA | 24 | 27 | | 1 | 112 | 40-150 | 01/02/2024 1817 |
| NMeFOSE | 240 | 280 | | 1 | 116 | 40-150 | 01/02/2024 1817 |
| NFDHA | 48 | 54 | | 1 | 114 | 40-150 | 01/02/2024 1817 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 51 | | 1 | 119 | 40-150 | 01/02/2024 1817 |
| PFMPA | 48 | 56 | | 1 | 117 | 40-150 | 01/02/2024 1817 |
| PFMBA | 48 | 53 | | 1 | 110 | 40-150 | 01/02/2024 1817 |
| PFBS | 21 | 25 | | 1 | 117 | 40-150 | 01/02/2024 1817 |
| PFBA | 96 | 110 | | 1 | 114 | 40-150 | 01/02/2024 1817 |
| PFDS | 23 | 25 | | 1 | 107 | 40-150 | 01/02/2024 1817 |
| PFDA | 24 | 28 | | 1 | 117 | 40-150 | 01/02/2024 1817 |
| PFDoS | 23 | 26 | | 1 | 110 | 40-150 | 01/02/2024 1817 |
| PFDoA | 24 | 28 | | 1 | 115 | 40-150 | 01/02/2024 1817 |
| PFHpS | 23 | 24 | | 1 | 106 | 40-150 | 01/02/2024 1817 |
| PFHpA | 24 | 27 | | 1 | 113 | 40-150 | 01/02/2024 1817 |
| 7:3FTCA | 600 | 630 | | 1 | 105 | 40-150 | 01/02/2024 1817 |
| PFHxS | 22 | 27 | M-03 | 1 | 124 | 40-150 | 01/02/2024 1817 |
| PFHxA | 24 | 30 | | 1 | 124 | 40-150 | 01/02/2024 1817 |
| PFNS | 23 | 25 | | 1 | 110 | 40-150 | 01/02/2024 1817 |
| PFNA | 24 | 28 | | 1 | 116 | 40-150 | 01/02/2024 1817 |
| PFOSA | 24 | 28 | | 1 | 115 | 40-150 | 01/02/2024 1817 |
| PFOS | 22 | 25 | M-03 | 1 | 113 | 40-150 | 01/02/2024 1817 |
| PFOA | 24 | 25 | | 1 | 106 | 40-150 | 01/02/2024 1817 |
| PFPeS | 23 | 26 | | 1 | 115 | 40-150 | 01/02/2024 1817 |
| PFPeA | 48 | 55 | | 1 | 114 | 40-150 | 01/02/2024 1817 |
| 3:3FTCA | 120 | 130 | | 1 | 107 | 40-150 | 01/02/2024 1817 |
| PFTeDA | 24 | 27 | | 1 | 113 | 40-150 | 01/02/2024 1817 |
| PFTrDA | 24 | 27 | | 1 | 113 | 40-150 | 01/02/2024 1817 |
| PFUnA | 24 | 27 | | 1 | 111 | 40-150 | 01/02/2024 1817 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 67 | 20-150 |
| 13C2-6:2FTS | | 68 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92532-002
Batch: 92532
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/18/2023 1345

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 73 | 20-150 |
| 13C2-PFDoA | | 72 | 20-150 |
| 13C2-PFTeDA | | 73 | 20-150 |
| 13C3-HFPO-DA | | 70 | 20-150 |
| 13C3-PFBS | | 75 | 20-150 |
| 13C3-PFHxS | | 69 | 20-150 |
| 13C4-PFBA | | 72 | 20-150 |
| 13C4-PFHpA | | 73 | 20-150 |
| 13C5-PFHxA | | 69 | 20-150 |
| 13C5-PFPeA | | 72 | 20-150 |
| 13C6-PFDA | | 70 | 20-150 |
| 13C7-PFUnA | | 71 | 20-150 |
| 13C8-PFOA | | 76 | 20-150 |
| 13C8-PFOS | | 74 | 20-150 |
| 13C8-PFOSA | | 70 | 20-150 |
| 13C9-PFNA | | 70 | 20-150 |
| D3-NMeFOSA | | 48 | 20-150 |
| D3-NMeFOSAA | | 70 | 20-150 |
| D5-NEtFOSA | | 48 | 20-150 |
| D5-NEtFOSAA | | 72 | 20-150 |
| D7-NMeFOSE | | 68 | 20-150 |
| D9-NEtFOSE | | 68 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92532-102
Batch: 92532
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/18/2023 1345

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.6 | | 1 | 101 | 40-150 | 01/02/2024 1827 |
| 9Cl-PF3ONS | 7.5 | 8.1 | | 1 | 109 | 40-150 | 01/02/2024 1827 |
| ADONA | 7.6 | 7.8 | | 1 | 103 | 40-150 | 01/02/2024 1827 |
| 8:2FTS | 7.7 | 7.7 | | 1 | 100 | 40-150 | 01/02/2024 1827 |
| 4:2FTS | 7.5 | 7.7 | | 1 | 103 | 40-150 | 01/02/2024 1827 |
| 6:2FTS | 7.6 | 9.6 | | 1 | 127 | 40-150 | 01/02/2024 1827 |
| 5:3FTCA | 50 | 46 | | 1 | 93 | 40-150 | 01/02/2024 1827 |
| HFPO-DA | 8.0 | 7.6 | M-03 | 1 | 95 | 40-150 | 01/02/2024 1827 |
| NEtFOSA | 2.0 | 2.0 | | 1 | 102 | 40-150 | 01/02/2024 1827 |
| NEtFOSAA | 2.0 | 2.0 | | 1 | 100 | 40-150 | 01/02/2024 1827 |
| NEtFOSE | 20 | 20 | | 1 | 98 | 40-150 | 01/02/2024 1827 |
| NMeFOSA | 2.0 | 2.1 | | 1 | 103 | 40-150 | 01/02/2024 1827 |
| NMeFOSAA | 2.0 | 2.0 | M-03 | 1 | 101 | 40-150 | 01/02/2024 1827 |
| NMeFOSE | 20 | 20 | | 1 | 102 | 40-150 | 01/02/2024 1827 |
| NFDHA | 4.0 | 3.9 | | 1 | 97 | 40-150 | 01/02/2024 1827 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.0 | | 1 | 112 | 40-150 | 01/02/2024 1827 |
| PFMPA | 4.0 | 3.8 | | 1 | 95 | 40-150 | 01/02/2024 1827 |
| PFMBA | 4.0 | 3.6 | | 1 | 89 | 40-150 | 01/02/2024 1827 |
| PFBS | 1.8 | 1.8 | M-03 | 1 | 104 | 40-150 | 01/02/2024 1827 |
| PFBA | 8.0 | 7.7 | | 1 | 97 | 40-150 | 01/02/2024 1827 |
| PFDS | 1.9 | 2.0 | | 1 | 102 | 40-150 | 01/02/2024 1827 |
| PFDA | 2.0 | 1.6 | M-03 | 1 | 81 | 40-150 | 01/02/2024 1827 |
| PFDoS | 1.9 | 1.9 | | 1 | 99 | 40-150 | 01/02/2024 1827 |
| PFDoA | 2.0 | 2.2 | | 1 | 108 | 40-150 | 01/02/2024 1827 |
| PFHpS | 1.9 | 1.8 | | 1 | 96 | 40-150 | 01/02/2024 1827 |
| PFHpA | 2.0 | 2.2 | | 1 | 108 | 40-150 | 01/02/2024 1827 |
| 7:3FTCA | 50 | 46 | | 1 | 91 | 40-150 | 01/02/2024 1827 |
| PFHxS | 1.8 | 1.9 | | 1 | 103 | 40-150 | 01/02/2024 1827 |
| PFHxA | 2.0 | 2.1 | | 1 | 107 | 40-150 | 01/02/2024 1827 |
| PFNS | 1.9 | 1.9 | | 1 | 101 | 40-150 | 01/02/2024 1827 |
| PFNA | 2.0 | 2.2 | M-03 | 1 | 112 | 40-150 | 01/02/2024 1827 |
| PFOSA | 2.0 | 2.1 | | 1 | 104 | 40-150 | 01/02/2024 1827 |
| PFOS | 1.9 | 1.8 | M-03 | 1 | 96 | 40-150 | 01/02/2024 1827 |
| PFOA | 2.0 | 2.0 | | 1 | 100 | 40-150 | 01/02/2024 1827 |
| PFPeS | 1.9 | 2.0 | | 1 | 107 | 40-150 | 01/02/2024 1827 |
| PFPeA | 4.0 | 3.9 | | 1 | 98 | 40-150 | 01/02/2024 1827 |
| 3:3FTCA | 10 | 8.7 | | 1 | 87 | 40-150 | 01/02/2024 1827 |
| PFTeDA | 2.0 | 2.2 | | 1 | 108 | 40-150 | 01/02/2024 1827 |
| PFTrDA | 2.0 | 2.1 | | 1 | 106 | 40-150 | 01/02/2024 1827 |
| PFUnA | 2.0 | 2.1 | | 1 | 103 | 40-150 | 01/02/2024 1827 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 76 | 20-150 |
| 13C2-6:2FTS | | 67 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92532-102
Batch: 92532
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/18/2023 1345

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 74 | 20-150 |
| 13C2-PFDoA | | 80 | 20-150 |
| 13C2-PFTeDA | | 80 | 20-150 |
| 13C3-HFPO-DA | | 86 | 20-150 |
| 13C3-PFBS | | 79 | 20-150 |
| 13C3-PFHxS | | 76 | 20-150 |
| 13C4-PFBA | | 82 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 |
| 13C5-PFHxA | | 83 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 |
| 13C6-PFDA | | 83 | 20-150 |
| 13C7-PFUnA | | 79 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 |
| 13C8-PFOS | | 81 | 20-150 |
| 13C8-PFOSA | | 80 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 |
| D3-NMeFOSA | | 60 | 20-150 |
| D3-NMeFOSAA | | 79 | 20-150 |
| D5-NEtFOSA | | 62 | 20-150 |
| D5-NEtFOSAA | | 88 | 20-150 |
| D7-NMeFOSE | | 78 | 20-150 |
| D9-NEtFOSE | | 78 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: YJ28005-001MS
Batch: 92532
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/18/2023 1345

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 4500 | 4900 | | 1 | 108 | 40-150 | 01/02/2024 1903 |
| 9Cl-PF3ONS | ND | 4500 | 5000 | | 1 | 111 | 40-150 | 01/02/2024 1903 |
| ADONA | ND | 4500 | 5200 | | 1 | 114 | 40-150 | 01/02/2024 1903 |
| 8:2FTS | 41 | 4600 | 4900 | | 1 | 105 | 40-150 | 01/02/2024 1903 |
| 4:2FTS | ND | 4500 | 5000 | | 1 | 111 | 40-150 | 01/02/2024 1903 |
| 6:2FTS | 270 | 4600 | 5700 | | 1 | 119 | 40-150 | 01/02/2024 1903 |
| 5:3FTCA | ND | 30000 | 31000 | | 1 | 102 | 40-150 | 01/02/2024 1903 |
| HFPO-DA | ND | 4800 | 5200 | | 1 | 108 | 40-150 | 01/02/2024 1903 |
| NEtFOSA | ND | 1200 | 1300 | | 1 | 107 | 40-150 | 01/02/2024 1903 |
| NEtFOSAA | ND | 1200 | 1300 | | 1 | 111 | 40-150 | 01/02/2024 1903 |
| NEtFOSE | ND | 12000 | 13000 | | 1 | 108 | 40-150 | 01/02/2024 1903 |
| NMeFOSA | ND | 1200 | 1300 | | 1 | 112 | 40-150 | 01/02/2024 1903 |
| NMeFOSAA | ND | 1200 | 1200 | | 1 | 97 | 40-150 | 01/02/2024 1903 |
| NMeFOSE | ND | 12000 | 13000 | | 1 | 107 | 40-150 | 01/02/2024 1903 |
| NFDHA | ND | 2400 | 2500 | | 1 | 106 | 40-150 | 01/02/2024 1903 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 2100 | 2200 | | 1 | 104 | 40-150 | 01/02/2024 1903 |
| PFMPA | ND | 2400 | 2700 | | 1 | 111 | 40-150 | 01/02/2024 1903 |
| PFMBA | ND | 2400 | 2600 | | 1 | 107 | 40-150 | 01/02/2024 1903 |
| PFBS | 61 | 1100 | 1200 | | 1 | 105 | 40-150 | 01/02/2024 1903 |
| PFBA | 120 | 4800 | 5300 | | 1 | 108 | 40-150 | 01/02/2024 1903 |
| PFDS | ND | 1200 | 1300 | | 1 | 114 | 40-150 | 01/02/2024 1903 |
| PFDA | ND | 1200 | 1200 | | 1 | 98 | 40-150 | 01/02/2024 1903 |
| PFDoS | ND | 1200 | 1300 | | 1 | 113 | 40-150 | 01/02/2024 1903 |
| PFDoA | ND | 1200 | 1300 | | 1 | 106 | 40-150 | 01/02/2024 1903 |
| PFHpS | 170 | 1100 | 1500 | | 1 | 117 | 40-150 | 01/02/2024 1903 |
| PFHpA | 240 | 1200 | 1700 | | 1 | 120 | 40-150 | 01/02/2024 1903 |
| 7:3FTCA | ND | 30000 | 30000 | | 1 | 101 | 40-150 | 01/02/2024 1903 |
| PFHxS | 3800 | 1100 | 5000 | | 1 | 109 | 40-150 | 01/02/2024 1903 |
| PFHxA | 470 | 1200 | 1800 | | 1 | 107 | 40-150 | 01/02/2024 1903 |
| PFNS | ND | 1200 | 1300 | | 1 | 112 | 40-150 | 01/02/2024 1903 |
| PFNA | 100 | 1200 | 1300 | | 1 | 104 | 40-150 | 01/02/2024 1903 |
| PFOSA | ND | 1200 | 1300 | | 1 | 107 | 40-150 | 01/02/2024 1903 |
| PFOS | 26000 | 1100 | 28000 | NM-03 | 1 | 241 | 40-150 | 01/02/2024 1903 |
| PFOA | 410 | 1200 | 1900 | M-03 | 1 | 121 | 40-150 | 01/02/2024 1903 |
| PFPeS | 150 | 1100 | 1500 | | 1 | 117 | 40-150 | 01/02/2024 1903 |
| PFPeA | 260 | 2400 | 2900 | | 1 | 110 | 40-150 | 01/02/2024 1903 |
| 3:3FTCA | ND | 6000 | 6200 | | 1 | 104 | 40-150 | 01/02/2024 1903 |
| PFTeDA | ND | 1200 | 1300 | | 1 | 109 | 40-150 | 01/02/2024 1903 |
| PFTrDA | ND | 1200 | 1300 | | 1 | 106 | 40-150 | 01/02/2024 1903 |
| PFUnA | ND | 1200 | 1300 | | 1 | 105 | 40-150 | 01/02/2024 1903 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 80 | 20-150 |
| 13C2-6:2FTS | | 76 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: YJ28005-001MS
Batch: 92532
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/18/2023 1345

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 80 | 20-150 |
| 13C2-PFDoA | | 77 | 20-150 |
| 13C2-PFTeDA | | 77 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 |
| 13C3-PFBS | | 81 | 20-150 |
| 13C3-PFHxS | | 77 | 20-150 |
| 13C4-PFBA | | 83 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 |
| 13C5-PFHxA | | 87 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 |
| 13C6-PFDA | | 87 | 20-150 |
| 13C7-PFUnA | | 79 | 20-150 |
| 13C8-PFOA | | 75 | 20-150 |
| 13C8-PFOS | | 81 | 20-150 |
| 13C8-PFOSA | | 91 | 20-150 |
| 13C9-PFNA | | 83 | 20-150 |
| D3-NMeFOSA | | 58 | 20-150 |
| D3-NMeFOSAA | | 89 | 20-150 |
| D5-NEtFOSA | | 57 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 |
| D7-NMeFOSE | | 81 | 20-150 |
| D9-NEtFOSE | | 79 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: YJ28005-001MD
Batch: 92532
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/18/2023 1345

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 4500 | 5100 | | 1 | 113 | 4.5 | 40-150 | 30 | 01/02/2024 1912 |
| 9Cl-PF3ONS | ND | 4500 | 5500 | | 1 | 122 | 9.1 | 40-150 | 30 | 01/02/2024 1912 |
| ADONA | ND | 4500 | 5500 | | 1 | 121 | 6.2 | 40-150 | 30 | 01/02/2024 1912 |
| 8:2FTS | 41 | 4600 | 5700 | | 1 | 123 | 16 | 40-150 | 30 | 01/02/2024 1912 |
| 4:2FTS | ND | 4500 | 5000 | | 1 | 111 | 0.031 | 40-150 | 30 | 01/02/2024 1912 |
| 6:2FTS | 270 | 4600 | 5200 | | 1 | 108 | 9.5 | 40-150 | 30 | 01/02/2024 1912 |
| 5:3FTCA | ND | 30000 | 34000 | | 1 | 114 | 11 | 40-150 | 30 | 01/02/2024 1912 |
| HFPO-DA | ND | 4800 | 5400 | | 1 | 113 | 4.6 | 40-150 | 30 | 01/02/2024 1912 |
| NEtFOSA | ND | 1200 | 1300 | | 1 | 106 | 0.59 | 40-150 | 30 | 01/02/2024 1912 |
| NEtFOSAA | ND | 1200 | 1200 | | 1 | 102 | 8.5 | 40-150 | 30 | 01/02/2024 1912 |
| NEtFOSE | ND | 12000 | 13000 | | 1 | 111 | 2.8 | 40-150 | 30 | 01/02/2024 1912 |
| NMeFOSA | ND | 1200 | 1300 | | 1 | 111 | 0.91 | 40-150 | 30 | 01/02/2024 1912 |
| NMeFOSAA | ND | 1200 | 1400 | M-03 | 1 | 116 | 18 | 40-150 | 30 | 01/02/2024 1912 |
| NMeFOSE | ND | 12000 | 14000 | | 1 | 114 | 6.3 | 40-150 | 30 | 01/02/2024 1912 |
| NFDHA | ND | 2400 | 2900 | | 1 | 123 | 15 | 40-150 | 30 | 01/02/2024 1912 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 2100 | 2700 | | 1 | 128 | 21 | 40-150 | 30 | 01/02/2024 1912 |
| PFMPA | ND | 2400 | 2800 | | 1 | 118 | 6.2 | 40-150 | 30 | 01/02/2024 1912 |
| PFMBA | ND | 2400 | 2700 | | 1 | 114 | 6.2 | 40-150 | 30 | 01/02/2024 1912 |
| PFBS | 61 | 1100 | 1200 | | 1 | 107 | 1.4 | 40-150 | 30 | 01/02/2024 1912 |
| PFBA | 120 | 4800 | 5400 | | 1 | 110 | 2.3 | 40-150 | 30 | 01/02/2024 1912 |
| PFDS | ND | 1200 | 1300 | | 1 | 111 | 3.5 | 40-150 | 30 | 01/02/2024 1912 |
| PFDA | ND | 1200 | 1200 | | 1 | 101 | 3.0 | 40-150 | 30 | 01/02/2024 1912 |
| PFDoS | ND | 1200 | 1300 | | 1 | 110 | 2.2 | 40-150 | 30 | 01/02/2024 1912 |
| PFDoA | ND | 1200 | 1300 | | 1 | 111 | 5.5 | 40-150 | 30 | 01/02/2024 1912 |
| PFHpS | 170 | 1100 | 1500 | | 1 | 113 | 2.5 | 40-150 | 30 | 01/02/2024 1912 |
| PFHpA | 240 | 1200 | 1600 | | 1 | 111 | 6.7 | 40-150 | 30 | 01/02/2024 1912 |
| 7:3FTCA | ND | 30000 | 34000 | | 1 | 114 | 12 | 40-150 | 30 | 01/02/2024 1912 |
| PFHxS | 3800 | 1100 | 6000 | N | 1 | 207 | 19 | 40-150 | 30 | 01/02/2024 1912 |
| PFHxA | 470 | 1200 | 2000 | | 1 | 124 | 11 | 40-150 | 30 | 01/02/2024 1912 |
| PFNS | ND | 1200 | 1300 | | 1 | 116 | 3.6 | 40-150 | 30 | 01/02/2024 1912 |
| PFNA | 100 | 1200 | 1400 | | 1 | 111 | 6.2 | 40-150 | 30 | 01/02/2024 1912 |
| PFOSA | ND | 1200 | 1300 | | 1 | 107 | 0.68 | 40-150 | 30 | 01/02/2024 1912 |
| PFOS | 26000 | 1100 | 27000 | M-03 | 1 | 118 | 5.0 | 40-150 | 30 | 01/02/2024 1912 |
| PFOA | 410 | 1200 | 1800 | M-03 | 1 | 119 | 1.4 | 40-150 | 30 | 01/02/2024 1912 |
| PFPeS | 150 | 1100 | 1700 | | 1 | 136 | 14 | 40-150 | 30 | 01/02/2024 1912 |
| PFPeA | 260 | 2400 | 3100 | | 1 | 117 | 5.6 | 40-150 | 30 | 01/02/2024 1912 |
| 3:3FTCA | ND | 6000 | 6700 | | 1 | 112 | 8.0 | 40-150 | 30 | 01/02/2024 1912 |
| PFTeDA | ND | 1200 | 1400 | | 1 | 115 | 5.4 | 40-150 | 30 | 01/02/2024 1912 |
| PFTrDA | ND | 1200 | 1400 | | 1 | 117 | 9.9 | 40-150 | 30 | 01/02/2024 1912 |
| PFUnA | ND | 1200 | 1300 | | 1 | 109 | 3.2 | 40-150 | 30 | 01/02/2024 1912 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 78 | 20-150 |
| 13C2-6:2FTS | | 80 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MSD

Sample ID: YJ28005-001MD
Batch: 92532
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/18/2023 1345

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 69 | 20-150 |
| 13C2-PFDoA | | 71 | 20-150 |
| 13C2-PFTeDA | | 67 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 |
| 13C3-PFBS | | 83 | 20-150 |
| 13C3-PFHxS | | 65 | 20-150 |
| 13C4-PFBA | | 79 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 |
| 13C5-PFHxA | | 77 | 20-150 |
| 13C5-PFPeA | | 82 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 |
| 13C8-PFOA | | 72 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 |
| 13C8-PFOSA | | 86 | 20-150 |
| 13C9-PFNA | | 75 | 20-150 |
| D3-NMeFOSA | | 55 | 20-150 |
| D3-NMeFOSAA | | 83 | 20-150 |
| D5-NEtFOSA | | 55 | 20-150 |
| D5-NEtFOSAA | | 80 | 20-150 |
| D7-NMeFOSE | | 76 | 20-150 |
| D9-NEtFOSE | | 76 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ92740-001
Batch: 92740
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/20/2023 1139

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 01/11/2024 0004 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 01/11/2024 0004 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 01/11/2024 0004 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 01/11/2024 0004 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 01/11/2024 0004 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 01/11/2024 0004 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 01/11/2024 0004 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 01/11/2024 0004 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 01/11/2024 0004 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 01/11/2024 0004 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 01/11/2024 0004 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 01/11/2024 0004 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 01/11/2024 0004 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 01/11/2024 0004 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 01/11/2024 0004 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 01/11/2024 0004 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 01/11/2024 0004 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 01/11/2024 0004 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 01/11/2024 0004 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 01/11/2024 0004 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 01/11/2024 0004 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 01/11/2024 0004 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 01/11/2024 0004 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 01/11/2024 0004 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 01/11/2024 0004 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 01/11/2024 0004 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 01/11/2024 0004 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 01/11/2024 0004 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 01/11/2024 0004 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 01/11/2024 0004 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 01/11/2024 0004 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 01/11/2024 0004 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 01/11/2024 0004 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 01/11/2024 0004 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 01/11/2024 0004 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 01/11/2024 0004 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 01/11/2024 0004 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 01/11/2024 0004 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 01/11/2024 0004 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 01/11/2024 0004 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 79 | 20-150 |
| 13C2-6:2FTS | | 77 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ92740-001
Batch: 92740
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/20/2023 1139

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 89 | 20-150 |
| 13C2-PFDoA | | 70 | 20-150 |
| 13C2-PFTeDA | | 62 | 20-150 |
| 13C3-HFPO-DA | | 83 | 20-150 |
| 13C3-PFBS | | 76 | 20-150 |
| 13C3-PFHxS | | 77 | 20-150 |
| 13C4-PFBA | | 83 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 |
| 13C5-PFHxA | | 84 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 |
| 13C6-PFDA | | 77 | 20-150 |
| 13C7-PFUnA | | 69 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 |
| 13C8-PFOS | | 76 | 20-150 |
| 13C8-PFOSA | | 70 | 20-150 |
| 13C9-PFNA | | 92 | 20-150 |
| D3-NMeFOSA | | 50 | 20-150 |
| D3-NMeFOSAA | | 71 | 20-150 |
| D5-NEtFOSA | | 47 | 20-150 |
| D5-NEtFOSAA | | 74 | 20-150 |
| D7-NMeFOSE | | 65 | 20-150 |
| D9-NEtFOSE | | 65 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92740-002
Batch: 92740
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/20/2023 1139

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 83 | | 1 | 92 | 40-150 | 01/11/2024 0013 |
| 9Cl-PF3ONS | 90 | 96 | | 1 | 107 | 40-150 | 01/11/2024 0013 |
| ADONA | 91 | 98 | | 1 | 108 | 40-150 | 01/11/2024 0013 |
| 8:2FTS | 92 | 96 | | 1 | 105 | 40-150 | 01/11/2024 0013 |
| 4:2FTS | 90 | 92 | | 1 | 102 | 40-150 | 01/11/2024 0013 |
| 6:2FTS | 91 | 94 | | 1 | 103 | 40-150 | 01/11/2024 0013 |
| 5:3FTCA | 600 | 600 | | 1 | 100 | 40-150 | 01/11/2024 0013 |
| HFPO-DA | 96 | 97 | | 1 | 101 | 40-150 | 01/11/2024 0013 |
| NEtFOSA | 24 | 25 | | 1 | 106 | 40-150 | 01/11/2024 0013 |
| NEtFOSAA | 24 | 24 | M-03 | 1 | 99 | 40-150 | 01/11/2024 0013 |
| NEtFOSE | 240 | 260 | | 1 | 108 | 40-150 | 01/11/2024 0013 |
| NMeFOSA | 24 | 27 | | 1 | 112 | 40-150 | 01/11/2024 0013 |
| NMeFOSAA | 24 | 26 | M-03 | 1 | 109 | 40-150 | 01/11/2024 0013 |
| NMeFOSE | 240 | 240 | | 1 | 101 | 40-150 | 01/11/2024 0013 |
| NFDHA | 48 | 51 | | 1 | 106 | 40-150 | 01/11/2024 0013 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 48 | | 1 | 113 | 40-150 | 01/11/2024 0013 |
| PFMPA | 48 | 51 | | 1 | 106 | 40-150 | 01/11/2024 0013 |
| PFMBA | 48 | 49 | | 1 | 102 | 40-150 | 01/11/2024 0013 |
| PFBS | 21 | 23 | | 1 | 109 | 40-150 | 01/11/2024 0013 |
| PFBA | 96 | 100 | | 1 | 106 | 40-150 | 01/11/2024 0013 |
| PFDS | 23 | 22 | | 1 | 95 | 40-150 | 01/11/2024 0013 |
| PFDA | 24 | 27 | | 1 | 111 | 40-150 | 01/11/2024 0013 |
| PFDoS | 23 | 23 | | 1 | 100 | 40-150 | 01/11/2024 0013 |
| PFDoA | 24 | 26 | | 1 | 108 | 40-150 | 01/11/2024 0013 |
| PFHpS | 23 | 27 | | 1 | 120 | 40-150 | 01/11/2024 0013 |
| PFHpA | 24 | 26 | | 1 | 109 | 40-150 | 01/11/2024 0013 |
| 7:3FTCA | 600 | 570 | | 1 | 94 | 40-150 | 01/11/2024 0013 |
| PFHxS | 22 | 23 | M-03 | 1 | 107 | 40-150 | 01/11/2024 0013 |
| PFHxA | 24 | 26 | | 1 | 108 | 40-150 | 01/11/2024 0013 |
| PFNS | 23 | 24 | | 1 | 102 | 40-150 | 01/11/2024 0013 |
| PFNA | 24 | 28 | | 1 | 115 | 40-150 | 01/11/2024 0013 |
| PFOSA | 24 | 26 | | 1 | 108 | 40-150 | 01/11/2024 0013 |
| PFOS | 22 | 25 | M-03 | 1 | 111 | 40-150 | 01/11/2024 0013 |
| PFOA | 24 | 26 | | 1 | 109 | 40-150 | 01/11/2024 0013 |
| PFPeS | 23 | 25 | | 1 | 110 | 40-150 | 01/11/2024 0013 |
| PFPeA | 48 | 51 | | 1 | 106 | 40-150 | 01/11/2024 0013 |
| 3:3FTCA | 120 | 110 | | 1 | 93 | 40-150 | 01/11/2024 0013 |
| PFTeDA | 24 | 26 | | 1 | 109 | 40-150 | 01/11/2024 0013 |
| PFTrDA | 24 | 27 | | 1 | 114 | 40-150 | 01/11/2024 0013 |
| PFUnA | 24 | 26 | | 1 | 108 | 40-150 | 01/11/2024 0013 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 79 | 20-150 |
| 13C2-6:2FTS | | 83 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92740-002
Batch: 92740
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/20/2023 1139

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 72 | 20-150 |
| 13C2-PFDoA | | 71 | 20-150 |
| 13C2-PFTeDA | | 73 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 |
| 13C3-PFBS | | 76 | 20-150 |
| 13C3-PFHxS | | 77 | 20-150 |
| 13C4-PFBA | | 79 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 |
| 13C5-PFPeA | | 86 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 |
| 13C8-PFOA | | 80 | 20-150 |
| 13C8-PFOS | | 74 | 20-150 |
| 13C8-PFOSA | | 71 | 20-150 |
| 13C9-PFNA | | 72 | 20-150 |
| D3-NMeFOSA | | 50 | 20-150 |
| D3-NMeFOSAA | | 71 | 20-150 |
| D5-NEtFOSA | | 53 | 20-150 |
| D5-NEtFOSAA | | 80 | 20-150 |
| D7-NMeFOSE | | 70 | 20-150 |
| D9-NEtFOSE | | 68 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92740-102
Batch: 92740
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/20/2023 1139

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 6.1 | | 1 | 81 | 40-150 | 01/11/2024 0022 |
| 9Cl-PF3ONS | 7.5 | 7.0 | | 1 | 93 | 40-150 | 01/11/2024 0022 |
| ADONA | 7.6 | 7.0 | | 1 | 93 | 40-150 | 01/11/2024 0022 |
| 8:2FTS | 7.7 | 7.9 | | 1 | 103 | 40-150 | 01/11/2024 0022 |
| 4:2FTS | 7.5 | 8.0 | M-03 | 1 | 107 | 40-150 | 01/11/2024 0022 |
| 6:2FTS | 7.6 | 8.3 | M-03 | 1 | 109 | 40-150 | 01/11/2024 0022 |
| 5:3FTCA | 50 | 46 | | 1 | 93 | 40-150 | 01/11/2024 0022 |
| HFPO-DA | 8.0 | 8.2 | M-03 | 1 | 102 | 40-150 | 01/11/2024 0022 |
| NEtFOSA | 2.0 | 2.0 | | 1 | 99 | 40-150 | 01/11/2024 0022 |
| NEtFOSAA | 2.0 | 1.8 | M-03 | 1 | 90 | 40-150 | 01/11/2024 0022 |
| NEtFOSE | 20 | 18 | | 1 | 92 | 40-150 | 01/11/2024 0022 |
| NMeFOSA | 2.0 | 1.8 | M-03 | 1 | 91 | 40-150 | 01/11/2024 0022 |
| NMeFOSAA | 2.0 | 1.9 | M-03 | 1 | 95 | 40-150 | 01/11/2024 0022 |
| NMeFOSE | 20 | 19 | | 1 | 94 | 40-150 | 01/11/2024 0022 |
| NFDHA | 4.0 | 4.0 | | 1 | 101 | 40-150 | 01/11/2024 0022 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.6 | | 1 | 101 | 40-150 | 01/11/2024 0022 |
| PFMPA | 4.0 | 3.9 | | 1 | 97 | 40-150 | 01/11/2024 0022 |
| PFMBA | 4.0 | 3.7 | | 1 | 92 | 40-150 | 01/11/2024 0022 |
| PFBS | 1.8 | 1.7 | | 1 | 94 | 40-150 | 01/11/2024 0022 |
| PFBA | 8.0 | 7.4 | | 1 | 93 | 40-150 | 01/11/2024 0022 |
| PFDS | 1.9 | 1.7 | M-03 | 1 | 87 | 40-150 | 01/11/2024 0022 |
| PFDA | 2.0 | 1.9 | M-03 | 1 | 96 | 40-150 | 01/11/2024 0022 |
| PFDoS | 1.9 | 1.8 | | 1 | 92 | 40-150 | 01/11/2024 0022 |
| PFDoA | 2.0 | 1.8 | M-03 | 1 | 92 | 40-150 | 01/11/2024 0022 |
| PFHpS | 1.9 | 2.0 | | 1 | 104 | 40-150 | 01/11/2024 0022 |
| PFHpA | 2.0 | 2.0 | M-03 | 1 | 99 | 40-150 | 01/11/2024 0022 |
| 7:3FTCA | 50 | 48 | | 1 | 96 | 40-150 | 01/11/2024 0022 |
| PFHxS | 1.8 | 1.6 | M-03 | 1 | 86 | 40-150 | 01/11/2024 0022 |
| PFHxA | 2.0 | 1.9 | M-03 | 1 | 93 | 40-150 | 01/11/2024 0022 |
| PFNS | 1.9 | 1.7 | | 1 | 89 | 40-150 | 01/11/2024 0022 |
| PFNA | 2.0 | 1.7 | M-03 | 1 | 84 | 40-150 | 01/11/2024 0022 |
| PFOSA | 2.0 | 2.0 | | 1 | 102 | 40-150 | 01/11/2024 0022 |
| PFOS | 1.9 | 2.8 | M-03 | 1 | 149 | 40-150 | 01/11/2024 0022 |
| PFOA | 2.0 | 1.9 | M-03 | 1 | 96 | 40-150 | 01/11/2024 0022 |
| PFPeS | 1.9 | 1.8 | | 1 | 96 | 40-150 | 01/11/2024 0022 |
| PFPeA | 4.0 | 3.7 | | 1 | 93 | 40-150 | 01/11/2024 0022 |
| 3:3FTCA | 10 | 9.3 | | 1 | 93 | 40-150 | 01/11/2024 0022 |
| PFTeDA | 2.0 | 2.0 | M-03 | 1 | 101 | 40-150 | 01/11/2024 0022 |
| PFTrDA | 2.0 | 1.7 | | 1 | 84 | 40-150 | 01/11/2024 0022 |
| PFUnA | 2.0 | 2.0 | | 1 | 99 | 40-150 | 01/11/2024 0022 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 106 | 20-150 |
| 13C2-6:2FTS | | 110 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92740-102
Batch: 92740
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/20/2023 1139

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 96 | 20-150 |
| 13C2-PFDoA | | 96 | 20-150 |
| 13C2-PFTeDA | | 83 | 20-150 |
| 13C3-HFPO-DA | | 108 | 20-150 |
| 13C3-PFBS | | 104 | 20-150 |
| 13C3-PFHxS | | 111 | 20-150 |
| 13C4-PFBA | | 106 | 20-150 |
| 13C4-PFHpA | | 106 | 20-150 |
| 13C5-PFHxA | | 106 | 20-150 |
| 13C5-PFPeA | | 110 | 20-150 |
| 13C6-PFDA | | 104 | 20-150 |
| 13C7-PFUnA | | 94 | 20-150 |
| 13C8-PFOA | | 117 | 20-150 |
| 13C8-PFOS | | 89 | 20-150 |
| 13C8-PFOSA | | 90 | 20-150 |
| 13C9-PFNA | | 110 | 20-150 |
| D3-NMeFOSA | | 77 | 20-150 |
| D3-NMeFOSAA | | 94 | 20-150 |
| D5-NEtFOSA | | 80 | 20-150 |
| D5-NEtFOSAA | | 91 | 20-150 |
| D7-NMeFOSE | | 89 | 20-150 |
| D9-NEtFOSE | | 90 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: YQ92830-001
Batch: 92830
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/21/2023 1102

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 01/11/2024 0430 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 01/11/2024 0430 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 01/11/2024 0430 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 01/11/2024 0430 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 01/11/2024 0430 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 01/11/2024 0430 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 01/11/2024 0430 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 01/11/2024 0430 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 01/11/2024 0430 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 01/11/2024 0430 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 01/11/2024 0430 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 01/11/2024 0430 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 01/11/2024 0430 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 01/11/2024 0430 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 01/11/2024 0430 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 01/11/2024 0430 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 01/11/2024 0430 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 01/11/2024 0430 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 01/11/2024 0430 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 01/11/2024 0430 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 01/11/2024 0430 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 01/11/2024 0430 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 01/11/2024 0430 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 01/11/2024 0430 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 01/11/2024 0430 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 01/11/2024 0430 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 01/11/2024 0430 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 01/11/2024 0430 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 01/11/2024 0430 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 01/11/2024 0430 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 01/11/2024 0430 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 01/11/2024 0430 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 01/11/2024 0430 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 01/11/2024 0430 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 01/11/2024 0430 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 01/11/2024 0430 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 01/11/2024 0430 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 01/11/2024 0430 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 01/11/2024 0430 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 01/11/2024 0430 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 72 | 20-150 |
| 13C2-6:2FTS | | 73 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MB

Sample ID: YQ92830-001
Batch: 92830
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/21/2023 1102

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 64 | 20-150 |
| 13C2-PFDoA | | 69 | 20-150 |
| 13C2-PFTeDA | | 62 | 20-150 |
| 13C3-HFPO-DA | | 74 | 20-150 |
| 13C3-PFBS | | 68 | 20-150 |
| 13C3-PFHxS | | 72 | 20-150 |
| 13C4-PFBA | | 74 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 |
| 13C5-PFHxA | | 76 | 20-150 |
| 13C5-PFPeA | | 76 | 20-150 |
| 13C6-PFDA | | 76 | 20-150 |
| 13C7-PFUnA | | 71 | 20-150 |
| 13C8-PFOA | | 77 | 20-150 |
| 13C8-PFOS | | 73 | 20-150 |
| 13C8-PFOSA | | 71 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 |
| D3-NMeFOSA | | 51 | 20-150 |
| D3-NMeFOSAA | | 75 | 20-150 |
| D5-NEtFOSA | | 49 | 20-150 |
| D5-NEtFOSAA | | 76 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 |
| D9-NEtFOSE | | 65 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92830-002
Batch: 92830
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/21/2023 1102

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 74 | | 1 | 81 | 40-150 | 01/11/2024 0439 |
| 9Cl-PF3ONS | 90 | 81 | | 1 | 90 | 40-150 | 01/11/2024 0439 |
| ADONA | 91 | 86 | | 1 | 95 | 40-150 | 01/11/2024 0439 |
| 8:2FTS | 92 | 93 | | 1 | 101 | 40-150 | 01/11/2024 0439 |
| 4:2FTS | 90 | 91 | | 1 | 101 | 40-150 | 01/11/2024 0439 |
| 6:2FTS | 91 | 95 | | 1 | 104 | 40-150 | 01/11/2024 0439 |
| 5:3FTCA | 600 | 590 | | 1 | 98 | 40-150 | 01/11/2024 0439 |
| HFPO-DA | 96 | 88 | | 1 | 91 | 40-150 | 01/11/2024 0439 |
| NEtFOSA | 24 | 25 | | 1 | 105 | 40-150 | 01/11/2024 0439 |
| NEtFOSAA | 24 | 26 | M-03 | 1 | 109 | 40-150 | 01/11/2024 0439 |
| NEtFOSE | 240 | 250 | | 1 | 103 | 40-150 | 01/11/2024 0439 |
| NMeFOSA | 24 | 25 | | 1 | 103 | 40-150 | 01/11/2024 0439 |
| NMeFOSAA | 24 | 26 | M-03 | 1 | 108 | 40-150 | 01/11/2024 0439 |
| NMeFOSE | 240 | 240 | | 1 | 100 | 40-150 | 01/11/2024 0439 |
| NFDHA | 48 | 51 | | 1 | 107 | 40-150 | 01/11/2024 0439 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 48 | | 1 | 113 | 40-150 | 01/11/2024 0439 |
| PFMPA | 48 | 53 | | 1 | 110 | 40-150 | 01/11/2024 0439 |
| PFMBA | 48 | 51 | | 1 | 107 | 40-150 | 01/11/2024 0439 |
| PFBS | 21 | 20 | | 1 | 94 | 40-150 | 01/11/2024 0439 |
| PFBA | 96 | 97 | | 1 | 101 | 40-150 | 01/11/2024 0439 |
| PFDS | 23 | 21 | | 1 | 90 | 40-150 | 01/11/2024 0439 |
| PFDA | 24 | 24 | | 1 | 98 | 40-150 | 01/11/2024 0439 |
| PFDoS | 23 | 19 | | 1 | 82 | 40-150 | 01/11/2024 0439 |
| PFDoA | 24 | 25 | | 1 | 104 | 40-150 | 01/11/2024 0439 |
| PFHpS | 23 | 22 | | 1 | 97 | 40-150 | 01/11/2024 0439 |
| PFHpA | 24 | 24 | | 1 | 102 | 40-150 | 01/11/2024 0439 |
| 7:3FTCA | 600 | 540 | | 1 | 91 | 40-150 | 01/11/2024 0439 |
| PFHxS | 22 | 23 | M-03 | 1 | 105 | 40-150 | 01/11/2024 0439 |
| PFHxA | 24 | 24 | | 1 | 102 | 40-150 | 01/11/2024 0439 |
| PFNS | 23 | 21 | | 1 | 91 | 40-150 | 01/11/2024 0439 |
| PFNA | 24 | 24 | | 1 | 101 | 40-150 | 01/11/2024 0439 |
| PFOSA | 24 | 24 | | 1 | 100 | 40-150 | 01/11/2024 0439 |
| PFOS | 22 | 21 | M-03 | 1 | 96 | 40-150 | 01/11/2024 0439 |
| PFOA | 24 | 23 | | 1 | 96 | 40-150 | 01/11/2024 0439 |
| PFPeS | 23 | 26 | | 1 | 114 | 40-150 | 01/11/2024 0439 |
| PFPeA | 48 | 47 | | 1 | 98 | 40-150 | 01/11/2024 0439 |
| 3:3FTCA | 120 | 120 | | 1 | 99 | 40-150 | 01/11/2024 0439 |
| PFTeDA | 24 | 26 | | 1 | 107 | 40-150 | 01/11/2024 0439 |
| PFTrDA | 24 | 24 | | 1 | 102 | 40-150 | 01/11/2024 0439 |
| PFUnA | 24 | 25 | | 1 | 105 | 40-150 | 01/11/2024 0439 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 80 | 20-150 |
| 13C2-6:2FTS | | 80 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92830-002
Batch: 92830
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/21/2023 1102

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 72 | 20-150 |
| 13C2-PFDoA | | 72 | 20-150 |
| 13C2-PFTeDA | | 65 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 |
| 13C3-PFBS | | 78 | 20-150 |
| 13C3-PFHxS | | 78 | 20-150 |
| 13C4-PFBA | | 77 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 |
| 13C5-PFHxA | | 79 | 20-150 |
| 13C5-PFPeA | | 82 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 |
| 13C7-PFUnA | | 70 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 |
| 13C8-PFOS | | 81 | 20-150 |
| 13C8-PFOSA | | 75 | 20-150 |
| 13C9-PFNA | | 75 | 20-150 |
| D3-NMeFOSA | | 54 | 20-150 |
| D3-NMeFOSAA | | 75 | 20-150 |
| D5-NEtFOSA | | 56 | 20-150 |
| D5-NEtFOSAA | | 74 | 20-150 |
| D7-NMeFOSE | | 77 | 20-150 |
| D9-NEtFOSE | | 74 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92830-102
Batch: 92830
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/21/2023 1102

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 6.7 | | 1 | 89 | 40-150 | 01/11/2024 0448 |
| 9Cl-PF3ONS | 7.5 | 7.1 | | 1 | 95 | 40-150 | 01/11/2024 0448 |
| ADONA | 7.6 | 7.4 | | 1 | 98 | 40-150 | 01/11/2024 0448 |
| 8:2FTS | 7.7 | 8.7 | M-03 | 1 | 114 | 40-150 | 01/11/2024 0448 |
| 4:2FTS | 7.5 | 7.8 | | 1 | 105 | 40-150 | 01/11/2024 0448 |
| 6:2FTS | 7.6 | 8.3 | | 1 | 110 | 40-150 | 01/11/2024 0448 |
| 5:3FTCA | 50 | 51 | | 1 | 102 | 40-150 | 01/11/2024 0448 |
| HFPO-DA | 8.0 | 8.1 | | 1 | 102 | 40-150 | 01/11/2024 0448 |
| NEtFOSA | 2.0 | 1.9 | | 1 | 94 | 40-150 | 01/11/2024 0448 |
| NEtFOSAA | 2.0 | 1.8 | M-03 | 1 | 90 | 40-150 | 01/11/2024 0448 |
| NEtFOSE | 20 | 19 | | 1 | 95 | 40-150 | 01/11/2024 0448 |
| NMeFOSA | 2.0 | 2.0 | M-03 | 1 | 98 | 40-150 | 01/11/2024 0448 |
| NMeFOSAA | 2.0 | 2.1 | M-03 | 1 | 106 | 40-150 | 01/11/2024 0448 |
| NMeFOSE | 20 | 19 | | 1 | 95 | 40-150 | 01/11/2024 0448 |
| NFDHA | 4.0 | 4.0 | | 1 | 100 | 40-150 | 01/11/2024 0448 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.5 | | 1 | 98 | 40-150 | 01/11/2024 0448 |
| PFMPA | 4.0 | 4.1 | | 1 | 102 | 40-150 | 01/11/2024 0448 |
| PFMBA | 4.0 | 4.1 | | 1 | 103 | 40-150 | 01/11/2024 0448 |
| PFBS | 1.8 | 1.6 | | 1 | 93 | 40-150 | 01/11/2024 0448 |
| PFBA | 8.0 | 7.7 | | 1 | 97 | 40-150 | 01/11/2024 0448 |
| PFDS | 1.9 | 1.6 | | 1 | 84 | 40-150 | 01/11/2024 0448 |
| PFDA | 2.0 | 1.8 | M-03 | 1 | 92 | 40-150 | 01/11/2024 0448 |
| PFDoS | 1.9 | 1.6 | | 1 | 84 | 40-150 | 01/11/2024 0448 |
| PFDoA | 2.0 | 1.9 | | 1 | 97 | 40-150 | 01/11/2024 0448 |
| PFHpS | 1.9 | 1.7 | | 1 | 92 | 40-150 | 01/11/2024 0448 |
| PFHpA | 2.0 | 2.0 | | 1 | 102 | 40-150 | 01/11/2024 0448 |
| 7:3FTCA | 50 | 47 | | 1 | 94 | 40-150 | 01/11/2024 0448 |
| PFHxS | 1.8 | 1.7 | M-03 | 1 | 95 | 40-150 | 01/11/2024 0448 |
| PFHxA | 2.0 | 2.0 | | 1 | 102 | 40-150 | 01/11/2024 0448 |
| PFNS | 1.9 | 1.7 | | 1 | 90 | 40-150 | 01/11/2024 0448 |
| PFNA | 2.0 | 2.3 | M-03 | 1 | 117 | 40-150 | 01/11/2024 0448 |
| PFOSA | 2.0 | 1.9 | | 1 | 96 | 40-150 | 01/11/2024 0448 |
| PFOS | 1.9 | 2.0 | M-03 | 1 | 106 | 40-150 | 01/11/2024 0448 |
| PFOA | 2.0 | 2.0 | | 1 | 101 | 40-150 | 01/11/2024 0448 |
| PFPeS | 1.9 | 2.0 | | 1 | 108 | 40-150 | 01/11/2024 0448 |
| PFPeA | 4.0 | 3.9 | M-03 | 1 | 97 | 40-150 | 01/11/2024 0448 |
| 3:3FTCA | 10 | 10 | M-03 | 1 | 100 | 40-150 | 01/11/2024 0448 |
| PFTeDA | 2.0 | 2.0 | | 1 | 101 | 40-150 | 01/11/2024 0448 |
| PFTrDA | 2.0 | 2.0 | | 1 | 102 | 40-150 | 01/11/2024 0448 |
| PFUnA | 2.0 | 2.1 | | 1 | 106 | 40-150 | 01/11/2024 0448 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 66 | 20-150 |
| 13C2-6:2FTS | | 71 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: YQ92830-102
Batch: 92830
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 12/21/2023 1102

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 57 | 20-150 |
| 13C2-PFDoA | | 59 | 20-150 |
| 13C2-PFTeDA | | 55 | 20-150 |
| 13C3-HFPO-DA | | 70 | 20-150 |
| 13C3-PFBS | | 71 | 20-150 |
| 13C3-PFHxS | | 67 | 20-150 |
| 13C4-PFBA | | 69 | 20-150 |
| 13C4-PFHpA | | 75 | 20-150 |
| 13C5-PFHxA | | 70 | 20-150 |
| 13C5-PFPeA | | 70 | 20-150 |
| 13C6-PFDA | | 63 | 20-150 |
| 13C7-PFUnA | | 59 | 20-150 |
| 13C8-PFOA | | 63 | 20-150 |
| 13C8-PFOS | | 69 | 20-150 |
| 13C8-PFOSA | | 65 | 20-150 |
| 13C9-PFNA | | 74 | 20-150 |
| D3-NMeFOSA | | 49 | 20-150 |
| D3-NMeFOSAA | | 65 | 20-150 |
| D5-NEtFOSA | | 50 | 20-150 |
| D5-NEtFOSAA | | 67 | 20-150 |
| D7-NMeFOSE | | 64 | 20-150 |
| D9-NEtFOSE | | 63 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 151054

| | | |
|---|---|---|
| Client: Arcadis | Report to Contact: Jesse Wright, Cameron Stewart | Telephone No. / E-mail: 317-496-2348 jesse.wright@arcadis.com, cameron.stewart@arcadis.com |
| Address: 28550 Cabot Dr #500 | Sampler's Signature: x | Analysis (Attach list if more space is needed) |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Madison Olender | |
| Project Name: GAAF GWS | | |
| Project No.: 30027244 | P.O. No.: | |

Page 1 of 3

YJ28005

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Comp / Composite | Matrix: Aqueous | Solid | Non-Aqueous | No of Containers by Preservative Type: Unpres. | HCl | HNO3 | H2SO4 | NaOH | Ascorbic Acid | Zma Acetate | Other | PFAS 537.1 – Method EPA Draft 1633 | MS MSD | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMT-VRTB-01_2_10232023 | 10/23/23 | 1203 | G | X | | | 3 | | | | | | | | X | | |
| CMT-VRTB-01_3_10232023 | | 1330 | | | | | | | | | | | | | | | |
| CMT-VRTB-01_4_10232023 | | 1435 | | | | | | | | | | | | | | | |
| CMT-VRTB-01_5_10232023 | | 1545 | | | | | 9 | | | | | | | | | X | |
| VRTB-L-MS_10232023 | | 1725 | | | | | 3 | | | | | | | | | | |
| VRTB-L-DUP_10242023 | 10/24/23 | 0923 | | | | | | | | | | | | | | | |
| VRTB-L-PZ_10242023 | | 1252 | | | | | | | | | | | | | | | |
| VRTB-L-BBB_10242023 | | 1343 | | | | | | | | | | | | | | | |
| VRTB-S-B1_10242023 | | 1516 | | | | | | | | | | | | | | | |
| VRTB-S-S2_10242023 | | 1706 | | | | | | | | | | | | | | | |

**Turn Around Time Required** (Prior lab approval required for expedited TAT): ☒ Standard ☐ Rush (Specify) Level II package (2 days)

**Sample Disposal**: ☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification**: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by: Arcadis | 10/27/23 | 1400 | 1. Received by | | |
| 2. Relinquished by | | | 2. Received by | | |
| 3. Relinquished by | | | 3. Received by | | |
| 4. Relinquished by: FedEx | 10/28/23 | 0910 | 4. Laboratory received by: Brittany Speers | 10/28/23 | 0910 |

LAB USE ONLY — Received on Ice (Circle): (Yes) No — Ice Pack: — Receipt Temp.: 0.9 °C — Temp Blank: ☑ Y ☐ N

*Note: All samples are retained for four weeks from receipt unless other arrangements are made.*

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01



PACE ANALYTICAL SERVICES, LLC

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 151052

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Jesse.wright@arcadis.com Cameron Stewart | Telephone No. / E-mail: 317- Jesse.wright@arcadis.com Cameron.Stewart@arcadis.com | Quote No. |
| Address: 28550 Cabot Dr #500 | Sampler's Signature: x | Analysis (Attach list if more space is needed) | Page 2 of 3 |
| City: Novi | State: MI | Zip Code: 48377 | Printed Name: Madison Olender |
| Project Name: GAAF GWS | | | |

YJ28005

KESP

| Project No. 30027244 | P.O. No. | | Grab/Comp C=Composite | Matrix: Aqueous, Solid, Non-Aqueous | No of Containers by Preservative Type: Unpres., HNO3, HCl, NaOH, H2SO4, MeOH, Other | Analysis: PFAS 1633 Draft 1 | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|
| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | | | | | |
| VRTB-S-Y3_10242023 | 10/24/23 | 1800 | G | X | 3 | X | |
| VRTB-S-G4_10252023 | 10/25/23 | 1025 | | | | | |
| VRTB-D-M5_10252023 | | 1154 | | | | | |
| VRTB-D-06_10252023 | | 1332 | | | | | |
| VRTB-D-R7_10252023 | | 1422 | | | | | |
| VRTB-D-P8_10252023 | | 1539 | | | | | |
| CMT-VRTB-01_6_10252023 | | 1726 | | | | | |
| VRTB-D-B1_10262023 | 10/26/23 | 0920 | | | | | |
| VRTB-D-S2_10262023 | | 1006 | | | | | |
| VRTB-D-Y3_10262023 | | 1100 | | | | | |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify) Level II package 4 days

**Sample Disposal**: ☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification**: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | Date | Time |
|---|---|---|
| 1. Relinquished by: Arcadis | 10/27/23 | 1400 |
| 2. Relinquished by: | | |
| 3. Relinquished by: | | |
| 4. Relinquished by: FedEX | 10/28/23 | 0910 |

| | Date | Time |
|---|---|---|
| 1. Received by: | | |
| 2. Received by: | | |
| 3. Received by: | | |
| 4. Laboratory received by: Whoopie Speers | 10/28/23 | 0910 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle): (Yes) No Ice Pack
Receipt Temp: 0.7 °C
Temp Blank: Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 151053

| | | |
|---|---|---|
| Client: Arcadis | Report to Contact: Jesse Wright, Cameron Stewart | Telephone No. / E-mail: jesse.wright@arcadis... 317-496-9248 cameron.stewart@arcadis... |
| Address: 28550 Cabot Dr # 500 | Sampler's Signature: | Quote No. |
| City: Novi / State: MI / Zip Code: 48377 | Printed Name: Madigan Olender | Page 3 of 3 |
| Project Name: GLAAF GWS | | |
| Project No.: 30027244 | P.O. No. | |

Analysis (Attach list if more space is needed): PFAS 414 - method EPA DW 1633

YJ28005

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab / Composite | Matrix: Aqueous | Solid | Non-Aqueous | No of Containers by Preservative Type: Unpres. | H2SO4 | HNO3 | HCl | NaOH | ascorbic | Field Filtered | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-D-G4_10262023 | 10/26/23 | 1148 | G | X | | | 3 | | | | | | X | |
| VRTB-S-O6_10262023 | | 1303 | | | | | | | | | | | | |
| VRTB-S-M5_10262023 | | 1431 | | | | | | | | | | | | |
| VRTB-S-R7_10262023 | | 1549 | | | | | | | | | | | | |
| VRTB-L-S2_10262023 | | 1703 | | | | | | | | | | | | |
| VRTB-L-G4_10262023 | | 1749 | | | | | | | | | | | | |
| VRTB-L-Y3_10262023 | | 1840 | | | | | | | | | | | | |
| VRTB-L-B1_10262023 | | 1925 | | | | | | | | | | | | |
| DUP-01_10242023 | 10/24/23 | — | | | | | | | | | | | | |
| DUP-02_10252023 | 10/25/23 | — | | | | | | | | | | | | |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.)
☒ Standard ☐ Rush (Specify) Level II package requ...

**Sample Disposal**
☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification**
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | Date | Time |
|---|---|---|
| 1. Relinquished by: Arcadis | 10/27/23 | 1400 |
| 2. Relinquished by: | | |
| 3. Relinquished by: | | |
| 4. Relinquished by: FedEx | 10/28/23 | 0910 |

| | Date | Time |
|---|---|---|
| 1. Received by: | | |
| 2. Received by: | | |
| 3. Received by: | | |
| 4. Laboratory received by: [illegible] | 10/28/23 | 0910 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle) (Yes) No Ice Pack — Receipt Temp 1.1 °C — Temp Blank ☒ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME009N2-01

DC#_Title: ENV-FRM-WCOL-0286 v02_Samples Receipt Checklist (SRC)
Effective Date: 8/2/2022

# Sample Receipt Checklist (SRC)

Client: ARCADIS  Cooler Inspected by/date: BRS2 / 10/28/23  Lot #: YJ28005

| | | | |
|---|---|---|---|
| Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: | | | |
| ☑ Yes | ☐ No | | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No | ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: NA

0.9 / 0.9 °C  0.7 / 0.7 °C  1.1 / 1.1 °C  NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles  IR Gun ID: _____  IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | ☐ NA | 3. Were all coolers received at or below 6.0°C? If no, was Project Manager notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 7. Was collection date & time listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 8. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 9. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 10. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? _____ |
| ☑ Yes | ☐ No | | 11. Was adequate sample volume available? |
| ☑ Yes | ☐ No | | 12. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☑ Yes | ☐ No | | 13. Were all samples containers accounted for? (No missing/excess) |
| ☐ Yes | ☐ No | ☑ NA | 14. Were VOA, 8015C and RSK-175 samples free of bubbles >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 15. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 16. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☐ Yes | ☑ No | ☐ NA | 18. Was the quote number listed on the container label? If yes, Quote # |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: $H_2SO_4$, $HNO_3$, HCl, NaOH using SR # NA . ☐
Time of preservation NA . If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Unique ID: NA .

Comments:

Qualtrax ID: 56360  Pace® Analytical Services, LLC  Page 1 of 1

# Performance Monitoring Event #6

# Report of Analysis

**Arcadis U.S., Inc.**
9954 Mayland Drive
Richmond, VA 23233
Attention: Cameron Stewart

Project Name: ESTCP Vertebrae

Lot Number:**ZA29006**

Date Completed:03/01/2024

Kathy Smith

03/04/2024 4:05 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: ZA29006

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.
Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.4 has been followed for these samples, and specifically Table B-24 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples were compliant with DOD QSM 5.4 table B-24 and our PFAS SOP.
Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). The CF is calculated as follows:

CF = DF * FV / Vo
FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a DoD/DOE accredited laboratory; however, the following analyses are currently not listed on our DoD/DOE scope of accreditation: Drinking Water: pH EPA 150.1, Turbidity EPA 180.1, Metals EPA 200.7 & 200.8, Mercury EPA 245.1, Anions EPA 300.0, Cyanide EPA 335.4, Nitrates EPA 353.2, Orthophosphate & Phosphorus EPA 365.1, EDB/DBCP EPA 504.1, HPC SIMPLATE, Color SM 2120 B-2011, Alkalinity SM 2320 B-2011, Specific Conductance SM 2510 B-2011, Residue-filterable (TDS) SM 2540 C, Calcium Hardness (CaCO2) SM 3500-Ca B-2011, TRC SM 4500 Cl G-2011, pH SM 4500 H=B-2011, E.Coli, Total Coliform. Non-Potable Water: Metals EPA 200.7, Strontium EPA 200.8, Chlorate EPA

300.0, Cyanide EPA 335.4, Phenolics EPA 420.4, 2-Methyl-4,6-Dinitrophenol EPA 625.1, Propane RSK-175, Specific Conductance SM 2510 B-2011, Salinity SM2520 B, Residue- total SM 2540 B, Sulfite SM 4500 SO32- B-2011, Amenable Cyanide SM 4500-CN- G-2011, BOD & CBOD SM 5210 B, MBAS SM 5540 C-2011, Boron & Titanium SW-846 6010D, Boron, Molybdenum, & Titanium SW-846 6020B, Alcohols & Glycols SW-846 8015C, Pentachlorophenol SW-846 8151A, Ethyl Acetate, Hexane, & n-Hexane SW-846 8260D, SVOC 1,4-Dioxane, 4-Dimethyl aminoazobenzene, 1,4-Naphthoquinone, 3,5-Dinitroaniline, PETN SW-846 8270E, Amenable Cyanide SW-846 9012B. Solid and Chemical Materials: Boron & Titanium SW-846 6010D, Molybdenum SW-846 6020B, Ethylene Glycol SW-846 8015B, Pentachlorophenol SW-846 8151A, Chloroprene SW-846 8260B, SVOC 1,4-Dioxane, 1,3,5-Trinitrobenzene, 1,4- Naphthoquinone, 1,4-Phenylenediamine, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 3-Methylcholanthrene, 4-Aminobiphenyl, 4-Dimethyl aminoazobenzene, 4-Nitroquinoline-1-oxide, 7,12-Dimethylbenzo(a)anthracene, Chlorobenzilate, Diallate, Ethyl methanesulfonate, Isodrin, Isosafrole, Methyl methanesulfonate, n-Nitrosomethylethylamine, n-Nitrosomorpholine, n-Nitrosopiperidine, Piperonyl butoxide, Pronamide, Safrole, 3,5- Dinitroaniline, PETN SW-846 8270E, Oil & Grease SW-846 9071B.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18. If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

PFAS
The LCS associated with batch 96299 had multiple compounds recovered outside the acceptance limits. Samples ZA29006-003, ZA29006-004, ZA29006-005 were re-extracted and re-anlayzed outside of holding time. All data has been reported.

Sample ZA29006-006 had surrogates and LCS recovered outside of the acceptance limits. The sample was re-extracted and all data has been reported.

Surrogate recovery for the following samples was outside control limits: ZA29006-012, ZA29016-014, ZA29016-015, ZA29006-021, ZA29006-022, ZA29006-023, ZA29006-026, ZA29006-027, ZA29006-030. Re-extraction and/or re-analysis was performed outside of holding time with acceptable results. All data has been reported.

Surrogate recovery for the following samples was outside control limits: ZA29006-018, ZA29006-019, ZA29006-020, ZA29006-024, ZA29006-025, ZA29006-028, ZA29006-029. Re-extraction and/or re-analysis was performed and the data has been reported.

The method blank associated with batches 96299, 96346, 96443, 97189, 97343 had PFOS detected at a concentration that was above the MDL but below the PQL. All samples associated with this method blank that have detections for PFOS have been flagged with a "B”.

The LCS associated with batch 97189 had multiple compounds recovered above the acceptance limits. This data has been reported.

The LCS associated with batches 96772, 97077 had 8:2 FTS recovered above the acceptance limits. This demonstrates a high bias on analytical results. There were no detections for this compound in the samples associated with this batch; therefore, data quality is not impacted.

The MS/MSD associated with samples ZA29006-021, ZA29006-022, ZA29006-028 had compounds recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-001 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-001 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-001 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-001 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-001 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-001 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-001 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZA29006-001 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZA29006-001 | 1 | 13C2-PFDoA | M-03 |
| 1633 | ZA29006-001 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZA29006-001 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZA29006-002 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZA29006-002 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-002 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-002 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZA29006-002 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-002 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-002 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-002 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-002 | 1 | 13C2-4:2FTS | M-03 |
| 1633 | ZA29006-002 | 1 | 13C2-6:2FTS | M-03 |
| 1633 | ZA29006-002 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZA29006-003 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZA29006-003 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-003 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-003 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-003 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-003 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZA29006-003 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-003 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-003 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZA29006-003 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZA29006-003 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZA29006-003 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZA29006-003 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZA29006-003 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-003 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-003 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-003 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-003 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-003 | 3 | 13C2-8:2FTS | M-03 |
| 1633 | ZA29006-003 | 3 | 13C6-PFDA | M-03 |
| 1633 | ZA29006-003 | 3 | 13C8-PFOA | M-03 |
| 1633 | ZA29006-004 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-004 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-004 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-004 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-004 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-004 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-004 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-004 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZA29006-004 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-004 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZA29006-004 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-004 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZA29006-004 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZA29006-004 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZA29006-005 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-005 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-005 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-005 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-005 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-005 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-005 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZA29006-005 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-005 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-005 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-005 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZA29006-005 | 2 | 13C3-PFHxS | M-03 |
| 1633 | ZA29006-006 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-006 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-006 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-006 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-006 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-006 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-006 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-006 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-006 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZA29006-006 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-006 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-006 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-006 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZA29006-007 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-007 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZA29006-007 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-007 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-007 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-007 | 1 | 13C2-4:2FTS | M-03 |
| 1633 | ZA29006-007 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-007 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZA29006-008 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-008 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-008 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZA29006-008 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-008 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZA29006-008 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-008 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-008 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-009 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-009 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZA29006-009 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-009 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-009 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-009 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-009 | 1 | 13C2-6:2FTS | M-03 |
| 1633 | ZA29006-009 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZA29006-010 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-010 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-010 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-010 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-010 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-010 | 1 | D3-NMeFOSAA | M-03 |
| 1633 | ZA29006-011 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-011 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-011 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZA29006-011 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-011 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-011 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZA29006-011 | 1 | D9-NEtFOSE | M-03 |
| 1633 | ZA29006-012 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-012 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-012 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZA29006-012 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-012 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-012 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-012 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-012 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZA29006-012 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-012 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-012 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZA29006-012 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZA29006-012 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZA29006-012 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZA29006-012 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-012 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-012 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-012 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-012 | 3 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-012 | 3 | 13C8-PFOS | M-03 |
| 1633 | ZA29006-012 | 3 | D5-NEtFOSAA | M-03 |
| 1633 | ZA29006-012 | 4 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZA29006-012 | 4 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-012 | 4 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-012 | 4 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-013 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-014 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-014 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-014 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-014 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZA29006-014 | 1 | D7-NMeFOSE | M-03 |
| 1633 | ZA29006-014 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-014 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-014 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-014 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZA29006-014 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-014 | 2 | 13C4-PFBA | M-03 |
| 1633 | ZA29006-014 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-014 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-014 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-014 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-014 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZA29006-014 | 3 | 13C2-6:2FTS | M-03 |
| 1633 | ZA29006-014 | 3 | 13C2-8:2FTS | M-03 |
| 1633 | ZA29006-015 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-015 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-015 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-015 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZA29006-015 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-015 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-015 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-015 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-015 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZA29006-015 | 3 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZA29006-015 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-015 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-015 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-015 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-016 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-016 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-016 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-016 | 2 | 13C4-PFBA | M-03 |
| 1633 | ZA29006-016 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZA29006-017 | 1 | 2H,2H,3H,3H-Perfluorooctanoic acid | M-03 |
| 1633 | ZA29006-017 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-017 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-017 | 1 | 13C2-PFDoA | M-03 |
| 1633 | ZA29006-017 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-017 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-017 | 2 | 13C4-PFBA | M-03 |
| 1633 | ZA29006-018 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-018 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-018 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-018 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-018 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-018 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZA29006-018 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZA29006-018 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-019 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-019 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-019 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-019 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-019 | 1 | 13C2-PFDoA | M-03 |
| 1633 | ZA29006-019 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-019 | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZA29006-019 | 1 | D7-NMeFOSE | M-03 |
| 1633 | ZA29006-020 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-020 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-020 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-021 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZA29006-021 | 1 | 2H,2H,3H,3H-Perfluorooctanoic acid | M-03 |
| 1633 | ZA29006-021 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-021 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-021 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-021 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-021 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZA29006-021 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-021 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZA29006-021 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZA29006-021 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZA29006-021 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZA29006-021 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZA29006-021 | 2 | 13C8-PFOA | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-021 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZA29006-021 | 2 | D5-NEtFOSA | M-03 |
| 1633 | ZA29006-021 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZA29006-021 | 2 | D7-NMeFOSE | M-03 |
| 1633 | ZA29006-021 | 3 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZA29006-021 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-021 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-021 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-021 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-022 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-022 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-022 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-022 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-022 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-022 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-022 | 1 | 13C4-PFBA | M-03 |
| 1633 | ZA29006-022 | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZA29006-022 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-022 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-022 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-022 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-022 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-022 | 2 | 13C4-PFBA | M-03 |
| 1633 | ZA29006-022 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZA29006-022 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZA29006-022 | 2 | 13C8-PFOSA | M-03 |
| 1633 | ZA29006-022 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-022 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-022 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-022 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZA29006-022 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-022 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-022 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-022 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-023 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-023 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZA29006-023 | 1 | Perfluorononanoic acid (PFNA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-023 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-023 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-023 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-023 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-023 | 1 | D5-NEtFOSAA | M-03 |
| 1633 | ZA29006-023 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZA29006-023 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZA29006-023 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-023 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-023 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-023 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-023 | 2 | D9-NEtFOSE | M-03 |
| 1633 | ZA29006-023 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-023 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-023 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-023 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-023 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-023 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZA29006-024 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZA29006-024 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZA29006-024 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZA29006-024 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-024 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZA29006-024 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-024 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-024 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-024 | 3 | 13C2-6:2FTS | M-03 |
| 1633 | ZA29006-024 | 3 | 13C2-8:2FTS | M-03 |
| 1633 | ZA29006-024 | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZA29006-024 | 3 | 13C7-PFUnA | M-03 |
| 1633 | ZA29006-024 | 3 | D7-NMeFOSE | M-03 |
| 1633 | ZA29006-025 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZA29006-025 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-025 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-025 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZA29006-025 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-025 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-025 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-025 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-025 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZA29006-025 | 3 | 13C2-PFDoA | M-03 |
| 1633 | ZA29006-025 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-025 | 2 | 13C3-PFHxS | M-03 |
| 1633 | ZA29006-025 | 2 | 13C8-PFOSA | M-03 |
| 1633 | ZA29006-025 | 1 | D5-NEtFOSA | M-03 |
| 1633 | ZA29006-026 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZA29006-026 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-026 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZA29006-026 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-026 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-026 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-026 | 1 | D5-NEtFOSAA | M-03 |
| 1633 | ZA29006-026 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZA29006-026 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZA29006-026 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-026 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-026 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-026 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-026 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZA29006-026 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZA29006-026 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZA29006-026 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZA29006-026 | 2 | D3-NMeFOSA | M-03 |
| 1633 | ZA29006-026 | 2 | D5-NEtFOSA | M-03 |
| 1633 | ZA29006-026 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZA29006-026 | 3 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZA29006-026 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-026 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-026 | 3 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZA29006-026 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-026 | 3 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-026 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-026 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-027 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-027 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZA29006-027 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-027 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-027 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-027 | 1 | 13C2-4:2FTS | M-03 |
| 1633 | ZA29006-027 | 1 | 13C2-PFDoA | M-03 |
| 1633 | ZA29006-027 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZA29006-027 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-027 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-027 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-027 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZA29006-027 | 2 | 13C3-PFHxS | M-03 |
| 1633 | ZA29006-027 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZA29006-027 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZA29006-027 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZA29006-027 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZA29006-027 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-027 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZA29006-027 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-027 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-027 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-027 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-027 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZA29006-027 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZA29006-028 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZA29006-028 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-028 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-028 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-028 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-028 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-028 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-028 | 3 | 13C2-8:2FTS | M-03 |
| 1633 | ZA29006-028 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-028 | 3 | 13C2-PFTeDA | M-03 |
| 1633 | ZA29006-028 | 3 | D5-NEtFOSAA | M-03 |
| 1633 | ZA29006-028 | 1 | D9-NEtFOSE | M-03 |
| 1633 | ZA29006-029 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-029 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-029 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-029 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-029 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-029 | 3 | 13C9-PFNA | M-03 |
| 1633 | ZA29006-029 | 2 | D5-NEtFOSA | M-03 |
| 1633 | ZA29006-030 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-030 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-030 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZA29006-030 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-030 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-030 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-030 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-030 | 1 | 13C2-PFDoA | M-03 |
| 1633 | ZA29006-030 | 1 | D3-NMeFOSAA | M-03 |
| 1633 | ZA29006-030 | 2 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZA29006-030 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-030 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-030 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-030 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-030 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-030 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-031 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZA29006-031 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZA29006-031 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-031 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-031 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZA29006-031 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-031 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-031 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-031 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZA29006-031 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZA29006-031 | 2 | 13C3-PFBS | M-03 |
| 1633 | ZQ96699-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ96699-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | ZQ96699-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ96699-002 | 1 | N-ethyl | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ96699-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ96699-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ96699-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ96699-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZQ96699-102 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | ZQ96699-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ96699-102 | 1 | Perfluorododecanesulfonic acid (PFDoS) | M-03 |
| 1633 | ZQ96699-102 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZQ96699-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ96699-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ96699-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ96699-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96699-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96699-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ96699-102 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZQ96699-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ96699-002 | 1 | 13C2-6:2FTS | M-03 |
| 1633 | ZQ96299-002 | 1 | 13C2-PFDoA | M-03 |
| 1633 | ZA29006-011DU | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ96299-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ96299-002 | 1 | N-methyl | M-03 |
| 1633 | ZA29006-011DU | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ96299-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-011DU | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-011DU | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZA29006-011DU | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-011DU | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ96299-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96299-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-011DU | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-011DU | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ96772-002 | 1 | 9-Chlorohexadecafluoro-3-oxanonane- | M-03 |
| 1633 | ZQ96772-102 | 1 | 9-Chlorohexadecafluoro-3-oxanonane- | M-03 |
| 1633 | ZQ96772-002 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ96772-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ96772-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ96772-102 | 1 | N-ethyl | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ96772-102 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ96772-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ96772-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ96772-002 | 1 | Perfluoro-3-methoxypropanoic acid | M-03 |
| 1633 | ZQ96772-002 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ96772-002 | 1 | Perfluorododecanesulfonic acid (PFDoS) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluorododecanesulfonic acid (PFDoS) | M-03 |
| 1633 | ZQ96772-002 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ96772-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ96772-002 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ96772-002 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ96772-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ96772-002 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ96772-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ96772-002 | 1 | 13C2-6:2FTS | M-03 |
| 1633 | ZQ96772-002 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZQ96772-102 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZQ96772-002 | 1 | 13C4-PFBA | M-03 |
| 1633 | ZQ96772-002 | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZQ96772-102 | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZQ96772-102 | 1 | 13C8-PFOA | M-03 |
| 1633 | ZQ96772-002 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZQ96772-001 | 1 | 13C9-PFNA | M-03 |
| 1633 | ZQ96772-002 | 1 | 13C9-PFNA | M-03 |
| 1633 | ZQ96772-102 | 1 | 13C9-PFNA | M-03 |
| 1633 | ZQ96772-001 | 1 | D3-NMeFOSAA | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ96772-002 | 1 | D5-NEtFOSAA | M-03 |
| 1633 | ZQ96753-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ96753-102 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | ZQ96753-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ96753-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96753-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96753-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ97189-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | ZQ97189-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ97189-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ97189-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ97189-102 | 1 | Perfluoro(2-ethoxyethane)sulfonic acid | M-03 |
| 1633 | ZQ97189-102 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | ZQ97189-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ97189-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ97189-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ97189-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ97189-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ97189-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ97189-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-014DU | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ96346-102 | 1 | N-ethyl | M-03 |
| 1633 | ZA29006-021MS | 1 | N-methyl | M-03 |
| 1633 | ZQ96346-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ96346-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ96346-102 | 1 | Nonafluoro-3,6-dioxaheptanoic acid | M-03 |
| 1633 | ZQ96346-102 | 1 | Perfluorododecanesulfonic acid (PFDoS) | M-03 |
| 1633 | ZA29006-014DU | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-021MS | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ96346-001 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ96346-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-021MS | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-014DU | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-021MS | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ96346-102 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZA29006-014DU | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ96346-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ96346-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-014DU | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96346-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-021MS | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ96346-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ96346-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ96346-001 | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZQ96346-102 | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZA29006-014DU | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZA29006-014DU | 1 | 13C8-PFOS | M-03 |
| 1633 | ZA29006-014DU | 1 | D7-NMeFOSE | M-03 |
| 1633 | ZQ96883-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ96883-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ96883-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ96883-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ96883-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZQ96883-102 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZQ96883-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ96883-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ96883-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ96883-001 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ96883-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96883-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96883-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ97343-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ97343-102 | 1 | 1H,1H,2H,2H-Perfluorohexane sulfonic | M-03 |
| 1633 | ZQ97343-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | ZQ97343-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ97343-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ97343-102 | 1 | Nonafluoro-3,6-dioxaheptanoic acid | M-03 |
| 1633 | ZQ97343-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZQ97343-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ97343-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ97343-001 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-08 |
| 1633 | ZQ97343-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ97343-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ97343-002 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-022MD | 3 | Perfluorooctanesulfonamide (PFOSA) | M-08 |
| 1633 | ZQ97343-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ97343-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ97343-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-022MS | 3 | Perfluorooctanesulfonic acid (PFOS) | M-08 |
| 1633 | ZA29006-022MD | 3 | Perfluorooctanesulfonic acid (PFOS) | M-08 |
| 1633 | ZQ97343-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-022MD | 3 | Perfluorooctanoic acid (PFOA) | M-08 |
| 1633 | ZQ97343-102 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZQ97343-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZA29006-022MS | 3 | 13C2-6:2FTS | M-08 |
| 1633 | ZA29006-022MS | 3 | 13C8-PFOSA | M-08 |
| 1633 | ZQ96443-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ96443-102 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZQ96443-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ96443-102 | 1 | N-ethyl | M-03 |
| 1633 | ZA29006-028MS | 1 | N-ethyl | M-03 |
| 1633 | ZA29006-028MD | 1 | N-ethyl | M-03 |
| 1633 | ZQ96443-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ96443-102 | 1 | N-methyl | M-03 |
| 1633 | ZA29006-028MS | 1 | N-methyl | M-03 |
| 1633 | ZA29006-028MD | 1 | N-methyl | M-03 |
| 1633 | ZQ96443-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ96443-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ96443-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-028MS | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-028MD | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ96443-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ96443-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-028MS | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-028MD | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ96443-102 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZQ96443-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZA29006-028MD | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ96443-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96443-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96443-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZA29006-028MS | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-028MD | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ96443-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-028MS | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-028MD | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ96443-102 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZQ96443-102 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZA29006-028MS | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZA29006-028MS | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ96443-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZA29006-028MS | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZA29006-028MD | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ97077-002 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ97077-102 | 1 | 1H,1H,2H,2H-Perfluorohexane sulfonic | M-03 |
| 1633 | ZQ97077-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ97077-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ97077-102 | 1 | N-ethyl | M-03 |
| 1633 | ZA29006-028MS | 3 | N-ethyl | M-03 |
| 1633 | ZA29006-028MD | 3 | N-ethyl | M-03 |
| 1633 | ZA29006-028MD | 3 | N-ethyl | M-03 |
| 1633 | ZQ97077-102 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ97077-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ97077-102 | 1 | N-methyl | M-03 |
| 1633 | ZA29006-028MS | 3 | N-methyl | M-03 |
| 1633 | ZA29006-028MD | 3 | N-methyl | M-03 |
| 1633 | ZQ97077-002 | 1 | Nonafluoro-3,6-dioxaheptanoic acid | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluoro-3-methoxypropanoic acid | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZA29006-028MS | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ97077-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-028MS | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZA29006-028MD | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ97077-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-028MS | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZA29006-028MD | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-028MS | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZA29006-028MD | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZQ97077-102 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZA29006-028MD | 3 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ97077-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ97077-001 | 1 | 13C2-4:2FTS | M-03 |
| 1633 | ZQ97077-001 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZA29006-028MD | 3 | 13C2-8:2FTS | M-03 |
| 1633 | ZQ97077-002 | 1 | 13C9-PFNA | M-03 |
| 1633 | ZQ97077-002 | 1 | D5-NEtFOSAA | M-03 |
| 1633 | ZA29006-028MD | 3 | D7-NMeFOSE | M-03 |

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | 01/22/2024 1535 | 01/27/2024 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | 01/22/2024 1620 | 01/27/2024 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | 01/22/2024 1700 | 01/27/2024 |
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | 01/22/2024 1735 | 01/27/2024 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | 01/22/2024 1805 | 01/27/2024 |
| 006 | VRTB-D-P8_01232024 | Aqueous | 01/23/2024 0855 | 01/27/2024 |
| 007 | VRTB-D-R7_01232024 | Aqueous | 01/23/2024 0950 | 01/27/2024 |
| 008 | VRTB-D-06_01232024 | Aqueous | 01/23/2024 1040 | 01/27/2024 |
| 009 | VRTB-D-M5_01232024 | Aqueous | 01/23/2024 1130 | 01/27/2024 |
| 010 | VRTB-S-G4_01232024 | Aqueous | 01/23/2024 1255 | 01/27/2024 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | 01/23/2024 1410 | 01/27/2024 |
| 012 | VRTB-S-S2_01232024 | Aqueous | 01/23/2024 1510 | 01/27/2024 |
| 013 | VRTB-S-B1_01232024 | Aqueous | 01/23/2024 1610 | 01/27/2024 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | 01/23/2024 1700 | 01/27/2024 |
| 015 | VRTB-L-P7_01232024 | Aqueous | 01/23/2024 1745 | 01/27/2024 |
| 016 | VRTB-L-06_01242024 | Aqueous | 01/24/2024 0910 | 01/27/2024 |
| 017 | VRTB-L-M5_01242024 | Aqueous | 01/24/2024 1005 | 01/27/2024 |
| 018 | VRTB-D-G4_01242024 | Aqueous | 01/24/2024 1135 | 01/27/2024 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | 01/24/2024 1245 | 01/27/2024 |
| 020 | VRTB-D-S2_01242024 | Aqueous | 01/24/2024 1345 | 01/27/2024 |
| 021 | VRTB-D-B1_01242024 | Aqueous | 01/24/2024 1455 | 01/27/2024 |
| 022 | VRTB-S-P8_01242024 | Aqueous | 01/24/2024 1535 | 01/27/2024 |
| 023 | VRTB-S-R7_01252024 | Aqueous | 01/25/2024 0845 | 01/27/2024 |
| 024 | VRTB-S-O6_01252024 | Aqueous | 01/25/2024 0950 | 01/27/2024 |
| 025 | VRTB-S-M5_01252024 | Aqueous | 01/25/2024 1035 | 01/27/2024 |
| 026 | VRTB-L-G4_01252024 | Aqueous | 01/25/2024 1125 | 01/27/2024 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | 01/25/2024 1220 | 01/27/2024 |
| 028 | VRTB-L-S2_01252024 | Aqueous | 01/25/2024 1255 | 01/27/2024 |
| 029 | VRTB-L-B1_01252024 | Aqueous | 01/25/2024 1405 | 01/27/2024 |
| 030 | DUP-01_01252024 | Aqueous | 01/25/2024 | 01/27/2024 |
| 031 | DUP-02_01252024 | Aqueous | 01/25/2024 | 01/27/2024 |

(31 samples)

## Detection Summary

### Arcadis U.S., Inc.

Lot Number: ZA29006

Project Name: ESTCP Vertebrae

Project Number:

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | 6:2FTS | 1633 | 320 | J | ng/L | 38 |
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | PFBS | 1633 | 44 | JM-03 | ng/L | 38 |
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | PFBA | 1633 | 110 | J | ng/L | 38 |
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | PFHpS | 1633 | 240 | M-03 | ng/L | 38 |
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | PFHpA | 1633 | 330 | | ng/L | 38 |
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | PFHxS | 1633 | 5300 | M-03 | ng/L | 38 |
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | PFHxA | 1633 | 430 | | ng/L | 38 |
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | PFNA | 1633 | 120 | M-03 | ng/L | 38 |
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | PFOS | 1633 | 31000 | M-03 | ng/L | 38 |
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | PFOA | 1633 | 630 | M-03 | ng/L | 38 |
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | PFPeS | 1633 | 110 | M-03 | ng/L | 38 |
| 001 | CMT-VRTB-01_2_01222024 | Aqueous | PFPeA | 1633 | 280 | M-03 | ng/L | 38 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | 8:2FTS | 1633 | 12 | JM-03 | ng/L | 40 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | PFBS | 1633 | 9.8 | JM-03 | ng/L | 40 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | PFBA | 1633 | 19 | JM-03 | ng/L | 40 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | PFHpS | 1633 | 38 | | ng/L | 40 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | PFHpA | 1633 | 47 | M-03 | ng/L | 40 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | PFHxS | 1633 | 1100 | M-03 | ng/L | 40 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | PFHxA | 1633 | 50 | | ng/L | 40 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | PFNA | 1633 | 40 | M-03 | ng/L | 40 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | PFOS | 1633 | 7000 | M-03 | ng/L | 40 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | PFOA | 1633 | 110 | M-03 | ng/L | 40 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | PFPeS | 1633 | 17 | J | ng/L | 40 |
| 002 | CMT-VRTB-01_3_01222024 | Aqueous | PFPeA | 1633 | 33 | J | ng/L | 40 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | 6:2FTS | 1633 | 7.3 | H | ng/L | 44 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | PFBS | 1633 | 14 | HM-03 | ng/L | 44 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | PFBA | 1633 | 12 | H | ng/L | 44 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | PFHpS | 1633 | 21 | HM-03 | ng/L | 44 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | PFHpA | 1633 | 27 | H | ng/L | 44 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | PFHxS | 1633 | 480 | H | ng/L | 44 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | PFHxA | 1633 | 26 | HM-03 | ng/L | 44 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | PFNA | 1633 | 9.2 | H | ng/L | 44 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | PFOA | 1633 | 49 | H | ng/L | 44 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | PFPeS | 1633 | 16 | H | ng/L | 44 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | PFPeA | 1633 | 16 | H | ng/L | 44 |
| 003 | CMT-VRTB-01_4_01222024 | Aqueous | PFOS | 1633 | 1500 | M-03 | ng/L | 46 |
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | PFBS | 1633 | 12 | HM-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | PFBA | 1633 | 12 | HM-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | PFHpS | 1633 | 11 | H | ng/L | 50 |
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | PFHpA | 1633 | 17 | HM-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | PFHxS | 1633 | 260 | HM-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | PFHxA | 1633 | 21 | HM-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | PFNA | 1633 | 2.0 | H | ng/L | 50 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | PFOS | 1633 | 380 | HM-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | PFOA | 1633 | 27 | H | ng/L | 50 |
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | PFPeS | 1633 | 15 | HM-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_5_01222024 | Aqueous | PFPeA | 1633 | 14 | H | ng/L | 50 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | PFBS | 1633 | 12 | HM-03 | ng/L | 54 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | PFBA | 1633 | 12 | H | ng/L | 54 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | PFHpS | 1633 | 11 | H | ng/L | 54 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | PFHpA | 1633 | 12 | H | ng/L | 54 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | PFHxS | 1633 | 150 | H | ng/L | 54 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | PFHxA | 1633 | 21 | HM-03 | ng/L | 54 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | PFNA | 1633 | 1.1 | HM-03 | ng/L | 54 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | PFOS | 1633 | 460 | HM-03 | ng/L | 54 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | PFOA | 1633 | 17 | HM-03 | ng/L | 54 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | PFPeS | 1633 | 11 | H | ng/L | 54 |
| 005 | CMT-VRTB-01_6_01222024 | Aqueous | PFPeA | 1633 | 15 | H | ng/L | 54 |
| 006 | VRTB-D-P8_01232024 | Aqueous | PFBS | 1633 | 9.5 | M-03 | ng/L | 58 |
| 006 | VRTB-D-P8_01232024 | Aqueous | PFBA | 1633 | 18 | JQ | ng/L | 58 |
| 006 | VRTB-D-P8_01232024 | Aqueous | PFHpS | 1633 | 2.2 | JM-03 | ng/L | 58 |
| 006 | VRTB-D-P8_01232024 | Aqueous | PFHpA | 1633 | 27 | M-03 | ng/L | 58 |
| 006 | VRTB-D-P8_01232024 | Aqueous | PFHxS | 1633 | 150 | M-03 | ng/L | 58 |
| 006 | VRTB-D-P8_01232024 | Aqueous | PFHxA | 1633 | 28 | | ng/L | 58 |
| 006 | VRTB-D-P8_01232024 | Aqueous | PFNA | 1633 | 6.8 | M-03 | ng/L | 58 |
| 006 | VRTB-D-P8_01232024 | Aqueous | PFOS | 1633 | 280 | M-03 | ng/L | 58 |
| 006 | VRTB-D-P8_01232024 | Aqueous | PFOA | 1633 | 22 | | ng/L | 58 |
| 006 | VRTB-D-P8_01232024 | Aqueous | PFPeS | 1633 | 4.6 | JM-03 | ng/L | 58 |
| 006 | VRTB-D-P8_01232024 | Aqueous | PFPeA | 1633 | 28 | | ng/L | 58 |
| 007 | VRTB-D-R7_01232024 | Aqueous | PFBS | 1633 | 6.6 | | ng/L | 60 |
| 007 | VRTB-D-R7_01232024 | Aqueous | PFBA | 1633 | 10 | J | ng/L | 60 |
| 007 | VRTB-D-R7_01232024 | Aqueous | PFHpS | 1633 | 1.3 | JM-03 | ng/L | 60 |
| 007 | VRTB-D-R7_01232024 | Aqueous | PFHpA | 1633 | 16 | M-03 | ng/L | 60 |
| 007 | VRTB-D-R7_01232024 | Aqueous | PFHxS | 1633 | 72 | M-03 | ng/L | 60 |
| 007 | VRTB-D-R7_01232024 | Aqueous | PFHxA | 1633 | 17 | | ng/L | 60 |
| 007 | VRTB-D-R7_01232024 | Aqueous | PFNA | 1633 | 1.5 | J | ng/L | 60 |
| 007 | VRTB-D-R7_01232024 | Aqueous | PFOS | 1633 | 98 | M-03 | ng/L | 60 |
| 007 | VRTB-D-R7_01232024 | Aqueous | PFOA | 1633 | 10 | M-03 | ng/L | 60 |
| 007 | VRTB-D-R7_01232024 | Aqueous | PFPeS | 1633 | 1.9 | J | ng/L | 60 |
| 007 | VRTB-D-R7_01232024 | Aqueous | PFPeA | 1633 | 17 | | ng/L | 60 |
| 008 | VRTB-D-06_01232024 | Aqueous | PFBS | 1633 | 3.1 | JM-03 | ng/L | 62 |
| 008 | VRTB-D-06_01232024 | Aqueous | PFBA | 1633 | 8.2 | J | ng/L | 62 |
| 008 | VRTB-D-06_01232024 | Aqueous | PFHpS | 1633 | 7.8 | M-03 | ng/L | 62 |
| 008 | VRTB-D-06_01232024 | Aqueous | PFHpA | 1633 | 6.7 | M-03 | ng/L | 62 |
| 008 | VRTB-D-06_01232024 | Aqueous | PFHxS | 1633 | 120 | M-03 | ng/L | 62 |
| 008 | VRTB-D-06_01232024 | Aqueous | PFHxA | 1633 | 11 | M-03 | ng/L | 62 |
| 008 | VRTB-D-06_01232024 | Aqueous | PFNA | 1633 | 1.4 | JM-03 | ng/L | 62 |
| 008 | VRTB-D-06_01232024 | Aqueous | PFOS | 1633 | 310 | M-03 | ng/L | 62 |
| 008 | VRTB-D-06_01232024 | Aqueous | PFOA | 1633 | 10 | M-03 | ng/L | 62 |
| 008 | VRTB-D-06_01232024 | Aqueous | PFPeS | 1633 | 5.7 | | ng/L | 62 |
| 008 | VRTB-D-06_01232024 | Aqueous | PFPeA | 1633 | 7.0 | J | ng/L | 62 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 009 | VRTB-D-M5_01232024 | Aqueous | PFBS | 1633 | 3.3 | JM-03 | ng/L | 64 |
| 009 | VRTB-D-M5_01232024 | Aqueous | PFBA | 1633 | 7.7 | J | ng/L | 64 |
| 009 | VRTB-D-M5_01232024 | Aqueous | PFHpS | 1633 | 3.8 | J | ng/L | 64 |
| 009 | VRTB-D-M5_01232024 | Aqueous | PFHpA | 1633 | 6.6 | M-03 | ng/L | 64 |
| 009 | VRTB-D-M5_01232024 | Aqueous | PFHxS | 1633 | 87 | M-03 | ng/L | 64 |
| 009 | VRTB-D-M5_01232024 | Aqueous | PFHxA | 1633 | 11 | | ng/L | 64 |
| 009 | VRTB-D-M5_01232024 | Aqueous | PFNA | 1633 | 1.3 | JM-03 | ng/L | 64 |
| 009 | VRTB-D-M5_01232024 | Aqueous | PFOS | 1633 | 290 | M-03 | ng/L | 64 |
| 009 | VRTB-D-M5_01232024 | Aqueous | PFOA | 1633 | 8.5 | M-03 | ng/L | 64 |
| 009 | VRTB-D-M5_01232024 | Aqueous | PFPeS | 1633 | 4.5 | J | ng/L | 64 |
| 010 | VRTB-S-G4_01232024 | Aqueous | PFBS | 1633 | 7.1 | M-03 | ng/L | 66 |
| 010 | VRTB-S-G4_01232024 | Aqueous | PFBA | 1633 | 5.4 | J | ng/L | 66 |
| 010 | VRTB-S-G4_01232024 | Aqueous | PFHpS | 1633 | 14 | | ng/L | 66 |
| 010 | VRTB-S-G4_01232024 | Aqueous | PFHpA | 1633 | 6.3 | | ng/L | 66 |
| 010 | VRTB-S-G4_01232024 | Aqueous | PFHxS | 1633 | 290 | M-03 | ng/L | 66 |
| 010 | VRTB-S-G4_01232024 | Aqueous | PFHxA | 1633 | 12 | | ng/L | 66 |
| 010 | VRTB-S-G4_01232024 | Aqueous | PFNA | 1633 | 0.57 | JM-03 | ng/L | 66 |
| 010 | VRTB-S-G4_01232024 | Aqueous | PFOS | 1633 | 800 | M-03 | ng/L | 66 |
| 010 | VRTB-S-G4_01232024 | Aqueous | PFOA | 1633 | 9.8 | | ng/L | 66 |
| 010 | VRTB-S-G4_01232024 | Aqueous | PFPeS | 1633 | 13 | | ng/L | 66 |
| 010 | VRTB-S-G4_01232024 | Aqueous | PFPeA | 1633 | 7.6 | JM-03 | ng/L | 66 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | PFBS | 1633 | 6.6 | | ng/L | 68 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | PFBA | 1633 | 13 | J | ng/L | 68 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | PFHpS | 1633 | 35 | M-03 | ng/L | 68 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | PFHpA | 1633 | 15 | | ng/L | 68 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | PFHxS | 1633 | 530 | M-03 | ng/L | 68 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | PFHxA | 1633 | 25 | M-03 | ng/L | 68 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | PFNA | 1633 | 3.9 | JM-03 | ng/L | 68 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | PFOS | 1633 | 1300 | M-03 | ng/L | 68 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | PFOA | 1633 | 28 | | ng/L | 68 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | PFPeS | 1633 | 13 | | ng/L | 68 |
| 011 | VRTB-S-Y3_01232024 | Aqueous | PFPeA | 1633 | 16 | | ng/L | 68 |
| 012 | VRTB-S-S2_01232024 | Aqueous | PFBS | 1633 | 6.5 | | ng/L | 72 |
| 012 | VRTB-S-S2_01232024 | Aqueous | PFBA | 1633 | 19 | | ng/L | 72 |
| 012 | VRTB-S-S2_01232024 | Aqueous | PFHpS | 1633 | 14 | M-03 | ng/L | 72 |
| 012 | VRTB-S-S2_01232024 | Aqueous | PFHpA | 1633 | 28 | | ng/L | 72 |
| 012 | VRTB-S-S2_01232024 | Aqueous | PFHxS | 1633 | 180 | | ng/L | 72 |
| 012 | VRTB-S-S2_01232024 | Aqueous | PFHxA | 1633 | 23 | M-03 | ng/L | 72 |
| 012 | VRTB-S-S2_01232024 | Aqueous | PFNA | 1633 | 25 | M-03 | ng/L | 72 |
| 012 | VRTB-S-S2_01232024 | Aqueous | PFOA | 1633 | 38 | M-03 | ng/L | 72 |
| 012 | VRTB-S-S2_01232024 | Aqueous | PFPeS | 1633 | 8.0 | | ng/L | 72 |
| 012 | VRTB-S-S2_01232024 | Aqueous | PFPeA | 1633 | 29 | | ng/L | 72 |
| 012 | VRTB-S-S2_01232024 | Aqueous | PFOS | 1633 | 830 | M-03 | ng/L | 74 |
| 013 | VRTB-S-B1_01232024 | Aqueous | PFBS | 1633 | 2.3 | | ng/L | 78 |
| 013 | VRTB-S-B1_01232024 | Aqueous | PFBA | 1633 | 4.8 | | ng/L | 78 |
| 013 | VRTB-S-B1_01232024 | Aqueous | PFHpS | 1633 | 1.2 | | ng/L | 78 |
| 013 | VRTB-S-B1_01232024 | Aqueous | PFHpA | 1633 | 2.1 | | ng/L | 78 |
| 013 | VRTB-S-B1_01232024 | Aqueous | PFHxS | 1633 | 30 | | ng/L | 78 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 013 | VRTB-S-B1_01232024 | Aqueous | PFHxA | 1633 | 4.6 | | ng/L | 78 |
| 013 | VRTB-S-B1_01232024 | Aqueous | PFOS | 1633 | 110 | B | ng/L | 78 |
| 013 | VRTB-S-B1_01232024 | Aqueous | PFOA | 1633 | 1.9 | M-03 | ng/L | 78 |
| 013 | VRTB-S-B1_01232024 | Aqueous | PFPeS | 1633 | 1.6 | | ng/L | 78 |
| 013 | VRTB-S-B1_01232024 | Aqueous | PFPeA | 1633 | 4.2 | | ng/L | 78 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | 8:2FTS | 1633 | 11 | | ng/L | 80 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | 6:2FTS | 1633 | 52 | | ng/L | 80 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFBS | 1633 | 18 | | ng/L | 80 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFBA | 1633 | 79 | | ng/L | 80 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFHpS | 1633 | 190 | | ng/L | 80 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFHpA | 1633 | 170 | | ng/L | 80 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFHxA | 1633 | 230 | | ng/L | 80 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFNA | 1633 | 49 | M-03 | ng/L | 80 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFOA | 1633 | 200 | | ng/L | 80 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFPeS | 1633 | 64 | | ng/L | 80 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFPeA | 1633 | 190 | | ng/L | 80 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFHxS | 1633 | 1200 | | ng/L | 82 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFOSA | 1633 | 1.1 | JM-03 | ng/L | 82 |
| 014 | VRTB-L-BB8_01232024 | Aqueous | PFOS | 1633 | 14000 | HM-03 | ng/L | 84 |
| 015 | VRTB-L-P7_01232024 | Aqueous | 8:2FTS | 1633 | 38 | | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | 6:2FTS | 1633 | 120 | | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | PFBS | 1633 | 13 | | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | PFBA | 1633 | 61 | | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | PFHpS | 1633 | 200 | | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | PFHpA | 1633 | 160 | | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | PFHxA | 1633 | 190 | | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | PFNA | 1633 | 63 | M-03 | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | PFOA | 1633 | 210 | | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | PFPeS | 1633 | 53 | | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | PFPeA | 1633 | 160 | | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | 3:3FTCA | 1633 | 1.7 | JM-03 | ng/L | 86 |
| 015 | VRTB-L-P7_01232024 | Aqueous | PFHxS | 1633 | 1600 | | ng/L | 88 |
| 015 | VRTB-L-P7_01232024 | Aqueous | PFOS | 1633 | 18000 | HM-03 | ng/L | 90 |
| 016 | VRTB-L-06_01242024 | Aqueous | 8:2FTS | 1633 | 61 | | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | 6:2FTS | 1633 | 200 | | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | PFBS | 1633 | 6.4 | | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | PFBA | 1633 | 50 | | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | PFHpS | 1633 | 230 | | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | PFHpA | 1633 | 170 | | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | PFHxS | 1633 | 1300 | | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | PFHxA | 1633 | 130 | | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | PFNA | 1633 | 110 | M-03 | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | PFOS | 1633 | 19000 | M-03 | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | PFOA | 1633 | 270 | | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | PFPeS | 1633 | 32 | | ng/L | 92 |
| 016 | VRTB-L-06_01242024 | Aqueous | PFPeA | 1633 | 140 | | ng/L | 92 |
| 017 | VRTB-L-M5_01242024 | Aqueous | 8:2FTS | 1633 | 44 | | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | 6:2FTS | 1633 | 110 | | ng/L | 94 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 017 | VRTB-L-M5_01242024 | Aqueous | PFBS | 1633 | 6.3 | | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | PFBA | 1633 | 34 | | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | PFDA | 1633 | 0.38 | J | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | PFHpS | 1633 | 160 | | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | PFHpA | 1633 | 110 | | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | PFHxS | 1633 | 850 | | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | PFHxA | 1633 | 91 | | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | PFNA | 1633 | 80 | M-03 | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | PFOS | 1633 | 11000 | M-03 | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | PFOA | 1633 | 190 | | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | PFPeS | 1633 | 22 | | ng/L | 94 |
| 017 | VRTB-L-M5_01242024 | Aqueous | PFPeA | 1633 | 95 | | ng/L | 94 |
| 018 | VRTB-D-G4_01242024 | Aqueous | PFBS | 1633 | 0.43 | JQ | ng/L | 96 |
| 018 | VRTB-D-G4_01242024 | Aqueous | PFBA | 1633 | 6.0 | | ng/L | 96 |
| 018 | VRTB-D-G4_01242024 | Aqueous | PFHpS | 1633 | 1.5 | M-03 | ng/L | 96 |
| 018 | VRTB-D-G4_01242024 | Aqueous | PFHpA | 1633 | 4.6 | | ng/L | 96 |
| 018 | VRTB-D-G4_01242024 | Aqueous | PFHxS | 1633 | 49 | M-03 | ng/L | 96 |
| 018 | VRTB-D-G4_01242024 | Aqueous | PFHxA | 1633 | 16 | | ng/L | 96 |
| 018 | VRTB-D-G4_01242024 | Aqueous | PFNA | 1633 | 0.26 | JQM-03 | ng/L | 96 |
| 018 | VRTB-D-G4_01242024 | Aqueous | PFOS | 1633 | 130 | M-03 | ng/L | 96 |
| 018 | VRTB-D-G4_01242024 | Aqueous | PFOA | 1633 | 4.4 | M-03 | ng/L | 96 |
| 018 | VRTB-D-G4_01242024 | Aqueous | PFPeS | 1633 | 2.0 | M-03 | ng/L | 96 |
| 018 | VRTB-D-G4_01242024 | Aqueous | PFPeA | 1633 | 19 | | ng/L | 96 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | PFBS | 1633 | 1.6 | | ng/L | 98 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | PFBA | 1633 | 2.5 | JM-03 | ng/L | 98 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | PFHpS | 1633 | 1.4 | M-03 | ng/L | 98 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | PFHpA | 1633 | 1.8 | | ng/L | 98 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | PFHxS | 1633 | 35 | | ng/L | 98 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | PFHxA | 1633 | 2.7 | | ng/L | 98 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | PFNA | 1633 | 0.25 | JM-03 | ng/L | 98 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | PFOS | 1633 | 60 | B | ng/L | 98 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | PFOA | 1633 | 2.8 | M-03 | ng/L | 98 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | PFPeS | 1633 | 4.1 | | ng/L | 98 |
| 019 | VRTB-D-Y3_01242024 | Aqueous | PFPeA | 1633 | 1.9 | | ng/L | 98 |
| 020 | VRTB-D-S2_01242024 | Aqueous | PFBS | 1633 | 16 | | ng/L | 100 |
| 020 | VRTB-D-S2_01242024 | Aqueous | PFBA | 1633 | 6.8 | M-03 | ng/L | 100 |
| 020 | VRTB-D-S2_01242024 | Aqueous | PFHpS | 1633 | 8.4 | | ng/L | 100 |
| 020 | VRTB-D-S2_01242024 | Aqueous | PFHpA | 1633 | 6.9 | | ng/L | 100 |
| 020 | VRTB-D-S2_01242024 | Aqueous | PFHxS | 1633 | 170 | | ng/L | 100 |
| 020 | VRTB-D-S2_01242024 | Aqueous | PFHxA | 1633 | 12 | | ng/L | 100 |
| 020 | VRTB-D-S2_01242024 | Aqueous | PFNA | 1633 | 0.77 | JM-03 | ng/L | 100 |
| 020 | VRTB-D-S2_01242024 | Aqueous | PFOS | 1633 | 250 | B | ng/L | 100 |
| 020 | VRTB-D-S2_01242024 | Aqueous | PFOA | 1633 | 14 | | ng/L | 100 |
| 020 | VRTB-D-S2_01242024 | Aqueous | PFPeS | 1633 | 40 | | ng/L | 100 |
| 020 | VRTB-D-S2_01242024 | Aqueous | PFPeA | 1633 | 7.7 | | ng/L | 100 |
| 021 | VRTB-D-B1_01242024 | Aqueous | 8:2FTS | 1633 | 2.2 | JSM-03 | ng/L | 102 |
| 021 | VRTB-D-B1_01242024 | Aqueous | 6:2FTS | 1633 | 59 | S | ng/L | 102 |
| 021 | VRTB-D-B1_01242024 | Aqueous | PFBS | 1633 | 11 | | ng/L | 102 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 021 | VRTB-D-B1_01242024 | Aqueous | PFBA | 1633 | 25 | S | ng/L | 102 |
| 021 | VRTB-D-B1_01242024 | Aqueous | PFHpS | 1633 | 42 | S | ng/L | 102 |
| 021 | VRTB-D-B1_01242024 | Aqueous | PFHpA | 1633 | 100 | | ng/L | 102 |
| 021 | VRTB-D-B1_01242024 | Aqueous | PFHxA | 1633 | 81 | | ng/L | 102 |
| 021 | VRTB-D-B1_01242024 | Aqueous | PFNA | 1633 | 15 | M-03 | ng/L | 102 |
| 021 | VRTB-D-B1_01242024 | Aqueous | PFOA | 1633 | 120 | | ng/L | 102 |
| 021 | VRTB-D-B1_01242024 | Aqueous | PFPeS | 1633 | 38 | | ng/L | 102 |
| 021 | VRTB-D-B1_01242024 | Aqueous | PFPeA | 1633 | 62 | S | ng/L | 102 |
| 021 | VRTB-D-B1_01242024 | Aqueous | PFHxS | 1633 | 780 | | ng/L | 104 |
| 021 | VRTB-D-B1_01242024 | Aqueous | PFOS | 1633 | 2400 | B | ng/L | 104 |
| 022 | VRTB-S-P8_01242024 | Aqueous | 6:2FTS | 1633 | 16 | | ng/L | 108 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFBS | 1633 | 55 | | ng/L | 108 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFBA | 1633 | 18 | M-03 | ng/L | 108 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFHpS | 1633 | 130 | | ng/L | 108 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFHpA | 1633 | 21 | | ng/L | 108 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFHxA | 1633 | 58 | | ng/L | 108 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFNA | 1633 | 19 | M-03 | ng/L | 108 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFOSA | 1633 | 0.26 | JQM-03 | ng/L | 108 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFOA | 1633 | 60 | | ng/L | 108 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFPeS | 1633 | 38 | | ng/L | 108 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFPeA | 1633 | 30 | | ng/L | 108 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFHxS | 1633 | 790 | M-03 | ng/L | 110 |
| 022 | VRTB-S-P8_01242024 | Aqueous | PFOS | 1633 | 9600 | BHSM-03 | ng/L | 112 |
| 023 | VRTB-S-R7_01252024 | Aqueous | 8:2FTS | 1633 | 63 | | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | 6:2FTS | 1633 | 110 | | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFBS | 1633 | 19 | | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFBA | 1633 | 57 | | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFHpS | 1633 | 280 | | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFHpA | 1633 | 160 | | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFHxA | 1633 | 230 | | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFNS | 1633 | 0.87 | JM-03 | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFNA | 1633 | 98 | M-03 | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFOSA | 1633 | 4.7 | M-03 | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFOA | 1633 | 280 | M-03 | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFPeS | 1633 | 69 | | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFPeA | 1633 | 130 | | ng/L | 114 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFHxS | 1633 | 2700 | M-03 | ng/L | 116 |
| 023 | VRTB-S-R7_01252024 | Aqueous | PFOS | 1633 | 27000 | HM-03 | ng/L | 118 |
| 024 | VRTB-S-O6_01252024 | Aqueous | 8:2FTS | 1633 | 0.87 | JM-03 | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | 6:2FTS | 1633 | 3.2 | JM-03 | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFBS | 1633 | 15 | | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFBA | 1633 | 16 | | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFDA | 1633 | 0.74 | JM-03 | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFHpS | 1633 | 88 | | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFHpA | 1633 | 16 | | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFHxS | 1633 | 520 | M-03 | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFHxA | 1633 | 36 | | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFNS | 1633 | 0.69 | JM-03 | ng/L | 120 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 024 | VRTB-S-O6_01252024 | Aqueous | PFNA | 1633 | 8.1 | | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFOSA | 1633 | 5.6 | M-03 | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFOS | 1633 | 2000 | BM-03 | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFOA | 1633 | 63 | M-03 | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFPeS | 1633 | 33 | | ng/L | 120 |
| 024 | VRTB-S-O6_01252024 | Aqueous | PFPeA | 1633 | 20 | | ng/L | 120 |
| 025 | VRTB-S-M5_01252024 | Aqueous | 8:2FTS | 1633 | 34 | M-03 | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | 6:2FTS | 1633 | 58 | | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFBS | 1633 | 7.3 | | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFBA | 1633 | 31 | M-03 | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFDA | 1633 | 0.36 | J | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFHpS | 1633 | 65 | M-03 | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFHpA | 1633 | 74 | | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFHxS | 1633 | 860 | | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFHxA | 1633 | 100 | | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFNS | 1633 | 0.24 | JM-03 | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFNA | 1633 | 23 | M-03 | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFOSA | 1633 | 0.63 | JM-03 | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFOS | 1633 | 4400 | BM-03 | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFOA | 1633 | 130 | M-03 | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFPeS | 1633 | 26 | | ng/L | 122 |
| 025 | VRTB-S-M5_01252024 | Aqueous | PFPeA | 1633 | 68 | | ng/L | 122 |
| 026 | VRTB-L-G4_01252024 | Aqueous | 8:2FTS | 1633 | 73 | | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | 6:2FTS | 1633 | 41 | | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFBS | 1633 | 5.4 | | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFBA | 1633 | 17 | | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFDA | 1633 | 0.29 | JM-03 | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFHpS | 1633 | 45 | | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFHpA | 1633 | 40 | | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFHxS | 1633 | 450 | M-03 | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFHxA | 1633 | 41 | | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFNS | 1633 | 0.29 | JM-03 | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFNA | 1633 | 28 | | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFOSA | 1633 | 1.9 | M-03 | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFOA | 1633 | 67 | M-03 | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFPeS | 1633 | 14 | | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFPeA | 1633 | 36 | | ng/L | 124 |
| 026 | VRTB-L-G4_01252024 | Aqueous | PFOS | 1633 | 4000 | BM-03 | ng/L | 126 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | 8:2FTS | 1633 | 77 | | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | 6:2FTS | 1633 | 6.7 | | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFBS | 1633 | 4.0 | | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFBA | 1633 | 8.7 | | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFHpS | 1633 | 17 | | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFHpA | 1633 | 13 | | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFHxS | 1633 | 150 | M-03 | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFHxA | 1633 | 14 | | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFNS | 1633 | 0.26 | JM-03 | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFNA | 1633 | 8.1 | | ng/L | 130 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFOSA | 1633 | 3.5 | M-03 | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFOA | 1633 | 25 | M-03 | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFPeS | 1633 | 6.3 | | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFPeA | 1633 | 13 | | ng/L | 130 |
| 027 | VRTB-L-Y3_01252024 | Aqueous | PFOS | 1633 | 1700 | BM-03 | ng/L | 132 |
| 028 | VRTB-L-S2_01252024 | Aqueous | 8:2FTS | 1633 | 9.7 | | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | 6:2FTS | 1633 | 4.3 | JM-03 | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFBS | 1633 | 5.3 | | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFBA | 1633 | 8.1 | | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFHpS | 1633 | 14 | M-03 | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFHpA | 1633 | 11 | | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFHxS | 1633 | 200 | M-03 | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFHxA | 1633 | 14 | | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFNA | 1633 | 4.4 | M-03 | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFOSA | 1633 | 1.3 | M-03 | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFOS | 1633 | 950 | BM-03 | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFOA | 1633 | 29 | M-03 | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFPeS | 1633 | 9.7 | | ng/L | 136 |
| 028 | VRTB-L-S2_01252024 | Aqueous | PFPeA | 1633 | 10 | | ng/L | 136 |
| 029 | VRTB-L-B1_01252024 | Aqueous | 8:2FTS | 1633 | 0.93 | J | ng/L | 138 |
| 029 | VRTB-L-B1_01252024 | Aqueous | PFBS | 1633 | 5.8 | | ng/L | 138 |
| 029 | VRTB-L-B1_01252024 | Aqueous | PFBA | 1633 | 7.6 | | ng/L | 138 |
| 029 | VRTB-L-B1_01252024 | Aqueous | PFHpS | 1633 | 12 | | ng/L | 138 |
| 029 | VRTB-L-B1_01252024 | Aqueous | PFHpA | 1633 | 7.7 | M-03 | ng/L | 138 |
| 029 | VRTB-L-B1_01252024 | Aqueous | PFHxS | 1633 | 150 | M-03 | ng/L | 138 |
| 029 | VRTB-L-B1_01252024 | Aqueous | PFHxA | 1633 | 13 | | ng/L | 138 |
| 029 | VRTB-L-B1_01252024 | Aqueous | PFNA | 1633 | 3.1 | M-03 | ng/L | 138 |
| 029 | VRTB-L-B1_01252024 | Aqueous | PFOS | 1633 | 630 | BM-03 | ng/L | 138 |
| 029 | VRTB-L-B1_01252024 | Aqueous | PFOA | 1633 | 22 | M-03 | ng/L | 138 |
| 029 | VRTB-L-B1_01252024 | Aqueous | PFPeS | 1633 | 9.1 | | ng/L | 138 |
| 029 | VRTB-L-B1_01252024 | Aqueous | PFPeA | 1633 | 9.5 | | ng/L | 138 |
| 030 | DUP-01_01252024 | Aqueous | 8:2FTS | 1633 | 60 | | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | 6:2FTS | 1633 | 130 | | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFBS | 1633 | 21 | | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFBA | 1633 | 54 | | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFHpS | 1633 | 280 | M-03 | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFHpA | 1633 | 180 | | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFHxA | 1633 | 220 | | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFNS | 1633 | 0.88 | JM-03 | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFNA | 1633 | 89 | M-03 | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFOSA | 1633 | 4.6 | M-03 | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFOA | 1633 | 270 | M-03 | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFPeS | 1633 | 67 | | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFPeA | 1633 | 130 | | ng/L | 140 |
| 030 | DUP-01_01252024 | Aqueous | PFHxS | 1633 | 2400 | | ng/L | 142 |
| 030 | DUP-01_01252024 | Aqueous | PFOS | 1633 | 27000 | HM-03 | ng/L | 144 |
| 031 | DUP-02_01252024 | Aqueous | 8:2FTS | 1633 | 73 | | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | 6:2FTS | 1633 | 35 | | ng/L | 146 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 031 | DUP-02_01252024 | Aqueous | PFBS | 1633 | 6.5 | M-03 | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFBA | 1633 | 17 | | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFDA | 1633 | 0.21 | JM-03 | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFHpS | 1633 | 45 | M-03 | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFHpA | 1633 | 40 | | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFHxS | 1633 | 450 | M-03 | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFHxA | 1633 | 42 | | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFNS | 1633 | 0.22 | JM-03 | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFNA | 1633 | 28 | | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFOSA | 1633 | 1.6 | M-03 | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFOS | 1633 | 4500 | BM-03 | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFOA | 1633 | 68 | M-03 | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFPeS | 1633 | 13 | | ng/L | 146 |
| 031 | DUP-02_01252024 | Aqueous | PFPeA | 1633 | 35 | | ng/L | 146 |

(393 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-001
Description: CMT-VRTB-01_2_01222024 | Matrix: Aqueous
Date Sampled: 01/22/2024 1535 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 2 | 1633 | 1633 | 1 | 02/22/2024 1139 | ALM | 02/19/2024 1132 | 96699 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | U | 400 | 230 | 87 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | U | 400 | 220 | 67 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | U | 400 | 230 | 66 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 150 | U | 400 | 150 | 61 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | U | 400 | 150 | 40 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 320 | J | 500 | 460 | 200 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | U | 2500 | 1000 | 430 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | U | 400 | 240 | 99 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | U | 100 | 40 | 13 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | U | 100 | 80 | 29 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | U | 1000 | 200 | 61 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | U | 100 | 80 | 22 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | U | 100 | 80 | 29 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | U | 1000 | 200 | 63 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | U | 200 | 130 | 58 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | U | 200 | 110 | 36 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | U | 200 | 64 | 18 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | U | 200 | 130 | 39 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 44 | JM-03 | 100 | 35 | 9.4 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 110 | J | 400 | 160 | 51 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | U | 100 | 39 | 16 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | U | 100 | 40 | 14 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | U | 100 | 39 | 15 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | U | 100 | 40 | 11 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 240 | M-03 | 100 | 38 | 19 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 330 | | 100 | 80 | 21 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | U | 2500 | 1000 | 420 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 5300 | M-03 | 100 | 73 | 18 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 430 | | 100 | 40 | 14 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | U | 100 | 38 | 15 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 120 | M-03 | 100 | 40 | 10 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 40 | U | 100 | 40 | 20 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 31000 | M-03 | 100 | 74 | 25 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 630 | M-03 | 100 | 80 | 21 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 110 | M-03 | 100 | 75 | 26 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 280 | M-03 | 200 | 40 | 18 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | U | 500 | 200 | 60 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | U | 100 | 80 | 27 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | U | 100 | 40 | 19 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | U | 100 | 80 | 25 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-001
Description: CMT-VRTB-01_2_01222024
Matrix: Aqueous
Date Sampled: 01/22/2024 1535
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 75 | 20-150 |
| 13C2-6:2FTS | | 75 | 20-150 |
| 13C2-8:2FTS | | 69 | 20-150 |
| 13C2-PFDoA | | 80 | 20-150 |
| 13C2-PFTeDA | | 82 | 20-150 |
| 13C3-HFPO-DA | | 83 | 20-150 |
| 13C3-PFBS | | 80 | 20-150 |
| 13C3-PFHxS | | 79 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 |
| 13C5-PFHxA | | 83 | 20-150 |
| 13C5-PFPeA | | 82 | 20-150 |
| 13C6-PFDA | | 87 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 |
| 13C8-PFOA | | 87 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 |
| 13C8-PFOSA | | 85 | 20-150 |
| 13C9-PFNA | M-03 | 81 | 20-150 |
| D3-NMeFOSA | | 60 | 20-150 |
| D3-NMeFOSAA | | 85 | 20-150 |
| D5-NEtFOSA | | 60 | 20-150 |
| D5-NEtFOSAA | | 82 | 20-150 |
| D7-NMeFOSE | | 73 | 20-150 |
| D9-NEtFOSE | | 74 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-002
Description: CMT-VRTB-01_3_01222024 | Matrix: Aqueous
Date Sampled: 01/22/2024 1620 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 2 | 1633 | 1633 | 1 | 02/22/2024 1148 | ALM | 02/19/2024 1132 | 96699 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 46 | U | 80 | 46 | 17 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 44 | U | 80 | 44 | 13 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 46 | U | 80 | 46 | 13 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 12 | JM-03 | 80 | 30 | 12 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 30 | U | 80 | 30 | 8.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 92 | U | 100 | 92 | 40 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 200 | U | 500 | 200 | 86 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 48 | U | 80 | 48 | 20 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 8.0 | U | 20 | 8.0 | 2.6 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 16 | U | 20 | 16 | 5.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 40 | U | 200 | 40 | 12 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 16 | U | 20 | 16 | 4.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 16 | U | 20 | 16 | 5.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 40 | U | 200 | 40 | 13 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 26 | U | 40 | 26 | 12 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 22 | U | 40 | 22 | 7.2 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 13 | U | 40 | 13 | 3.7 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 26 | U | 40 | 26 | 7.8 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.8 | JM-03 | 20 | 7.0 | 1.9 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 19 | JM-03 | 80 | 32 | 10 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 7.8 | U | 20 | 7.8 | 3.3 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 8.0 | U | 20 | 8.0 | 2.7 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 7.8 | U | 20 | 7.8 | 3.1 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 8.0 | U | 20 | 8.0 | 2.1 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 38 | | 20 | 7.6 | 3.8 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 47 | M-03 | 20 | 16 | 4.3 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 200 | U | 500 | 200 | 84 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1100 | M-03 | 20 | 15 | 3.7 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 50 | | 20 | 8.0 | 2.8 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 7.6 | U | 20 | 7.6 | 2.9 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 40 | M-03 | 20 | 8.0 | 2.1 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 8.0 | U | 20 | 8.0 | 4.0 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 7000 | M-03 | 20 | 15 | 4.9 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 110 | M-03 | 20 | 16 | 4.2 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 17 | J | 20 | 15 | 5.1 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 33 | J | 40 | 8.0 | 3.7 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 40 | U | 100 | 40 | 12 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 16 | U | 20 | 16 | 5.4 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 8.0 | U | 20 | 8.0 | 3.9 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 16 | U | 20 | 16 | 5.0 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-002
Description: CMT-VRTB-01_3_01222024
Matrix: Aqueous
Date Sampled: 01/22/2024 1620
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 75 | 20-150 |
| 13C2-6:2FTS | M-03 | 86 | 20-150 |
| 13C2-8:2FTS | | 65 | 20-150 |
| 13C2-PFDoA | | 70 | 20-150 |
| 13C2-PFTeDA | | 74 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 |
| 13C3-PFBS | | 83 | 20-150 |
| 13C3-PFHxS | | 77 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 |
| 13C5-PFHxA | | 83 | 20-150 |
| 13C5-PFPeA | | 83 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 |
| 13C8-PFOA | | 74 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 |
| 13C8-PFOSA | | 77 | 20-150 |
| 13C9-PFNA | | 77 | 20-150 |
| D3-NMeFOSA | | 61 | 20-150 |
| D3-NMeFOSAA | | 83 | 20-150 |
| D5-NEtFOSA | | 60 | 20-150 |
| D5-NEtFOSAA | | 76 | 20-150 |
| D7-NMeFOSE | | 67 | 20-150 |
| D9-NEtFOSE | | 67 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-003

Description: CMT-VRTB-01_4_01222024 | Matrix: Aqueous

Date Sampled: 01/22/2024 1700 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2001 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/21/2024 2229 | BWS | 02/20/2024 1023 | 96772 |
| 3 | 1633 | 1633 | 5 | 02/24/2024 1843 | ARC2 | 02/20/2024 1023 | 96772 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | UL | 3.8 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | UL | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | UL | 3.8 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.7 | JLM-03 | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | UL | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 5.7 | L | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | UL | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | UL | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UL | 9.6 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UL | 9.6 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UL | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | UL | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | UL | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UL | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 11 | L | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 10 | L | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | UL | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | UL | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 17 | L | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 20 | L | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | UL | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 500 | LM-03 | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 22 | L | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | UL | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 7.6 | L | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.22 | JLM-03 | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1100 | BELM-03 | 0.96 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 48 | LM-03 | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 16 | LM-03 | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 14 | L | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | UL | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-003
Description: CMT-VRTB-01_4_01222024
Matrix: Aqueous
Date Sampled: 01/22/2024 1700
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 | H | 136 | 20-150 | | 79 | 20-150 |
| 13C2-6:2FTS | | 86 | 20-150 | H | 94 | 20-150 | | 67 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | HM-03 | 96 | 20-150 | M-03 | 74 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 | H | 63 | 20-150 | | 57 | 20-150 |
| 13C2-PFTeDA | | 71 | 20-150 | H | 63 | 20-150 | | 57 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | H | 69 | 20-150 | | 78 | 20-150 |
| 13C3-PFBS | | 94 | 20-150 | H | 94 | 20-150 | | 75 | 20-150 |
| 13C3-PFHxS | | 87 | 20-150 | H | 88 | 20-150 | | 80 | 20-150 |
| 13C4-PFBA | | 92 | 20-150 | H | 80 | 20-150 | | 78 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | H | 56 | 20-150 | | 77 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 | H | 63 | 20-150 | | 79 | 20-150 |
| 13C5-PFPeA | | 101 | 20-150 | H | 97 | 20-150 | | 84 | 20-150 |
| 13C6-PFDA | | 87 | 20-150 | H | 82 | 20-150 | M-03 | 75 | 20-150 |
| 13C7-PFUnA | | 83 | 20-150 | HM-03 | 77 | 20-150 | | 60 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | H | 75 | 20-150 | M-03 | 69 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 | HM-03 | 81 | 20-150 | | 62 | 20-150 |
| 13C8-PFOSA | | 108 | 20-150 | H | 86 | 20-150 | | 62 | 20-150 |
| 13C9-PFNA | | 106 | 20-150 | H | 78 | 20-150 | | 70 | 20-150 |
| D3-NMeFOSA | | 91 | 20-150 | H | 67 | 20-150 | | 51 | 20-150 |
| D3-NMeFOSAA | | 105 | 20-150 | H | 79 | 20-150 | | 58 | 20-150 |
| D5-NEtFOSA | | 86 | 20-150 | H | 69 | 20-150 | | 52 | 20-150 |
| D5-NEtFOSAA | | 101 | 20-150 | HM-03 | 70 | 20-150 | | 51 | 20-150 |
| D7-NMeFOSE | | 95 | 20-150 | H | 74 | 20-150 | | 60 | 20-150 |
| D9-NEtFOSE | | 86 | 20-150 | H | 73 | 20-150 | | 59 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-003
Description: CMT-VRTB-01_4_01222024 | Matrix: Aqueous
Date Sampled: 01/22/2024 1700 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2001 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/21/2024 2229 | BWS | 02/20/2024 1023 | 96772 |
| 3 | 1633 | 1633 | 5 | 02/24/2024 1843 | ARC2 | 02/20/2024 1023 | 96772 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | UH | 3.9 | 2.2 | 0.85 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | UH | 3.9 | 2.1 | 0.65 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | UH | 3.9 | 2.2 | 0.65 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | UHL | 3.9 | 1.5 | 0.60 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | UH | 3.9 | 1.5 | 0.39 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 7.3 | H | 4.9 | 4.5 | 2.0 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | UH | 24 | 9.6 | 4.2 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | UH | 3.9 | 2.3 | 0.97 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | UH | 0.98 | 0.39 | 0.13 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | UH | 0.98 | 0.78 | 0.28 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | UH | 9.8 | 2.0 | 0.60 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | UH | 0.98 | 0.78 | 0.21 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | UH | 0.98 | 0.78 | 0.29 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | UH | 9.8 | 2.0 | 0.62 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | UH | 2.0 | 1.3 | 0.56 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | UH | 2.0 | 1.1 | 0.35 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | UH | 2.0 | 0.64 | 0.18 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | UH | 2.0 | 1.3 | 0.38 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 14 | HM-03 | 0.98 | 0.34 | 0.092 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 12 | H | 3.9 | 1.6 | 0.50 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | UH | 0.98 | 0.38 | 0.16 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.39 | UH | 0.98 | 0.39 | 0.13 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | UH | 0.98 | 0.38 | 0.15 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | UH | 0.98 | 0.39 | 0.10 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 21 | HM-03 | 0.98 | 0.37 | 0.19 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 27 | H | 0.98 | 0.78 | 0.21 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | UH | 24 | 9.6 | 4.1 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 480 | H | 0.98 | 0.72 | 0.18 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 26 | HM-03 | 0.98 | 0.39 | 0.14 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.37 | UH | 0.98 | 0.37 | 0.14 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 9.2 | H | 0.98 | 0.39 | 0.10 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.39 | UH | 0.98 | 0.39 | 0.19 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 0.73 | UH | 0.98 | 0.73 | 0.24 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 49 | H | 0.98 | 0.78 | 0.20 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 16 | H | 0.98 | 0.74 | 0.25 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 16 | H | 2.0 | 0.40 | 0.18 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | UH | 4.9 | 2.0 | 0.58 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | UH | 0.98 | 0.78 | 0.26 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | UH | 0.98 | 0.39 | 0.19 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | UH | 0.98 | 0.78 | 0.24 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-003
Description: CMT-VRTB-01_4_01222024
Matrix: Aqueous
Date Sampled: 01/22/2024 1700
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 | H | 136 | 20-150 | | 79 | 20-150 |
| 13C2-6:2FTS | | 86 | 20-150 | H | 94 | 20-150 | | 67 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | HM-03 | 96 | 20-150 | M-03 | 74 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 | H | 63 | 20-150 | | 57 | 20-150 |
| 13C2-PFTeDA | | 71 | 20-150 | H | 63 | 20-150 | | 57 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | H | 69 | 20-150 | | 78 | 20-150 |
| 13C3-PFBS | | 94 | 20-150 | H | 94 | 20-150 | | 75 | 20-150 |
| 13C3-PFHxS | | 87 | 20-150 | H | 88 | 20-150 | | 80 | 20-150 |
| 13C4-PFBA | | 92 | 20-150 | H | 80 | 20-150 | | 78 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | H | 56 | 20-150 | | 77 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 | H | 63 | 20-150 | | 79 | 20-150 |
| 13C5-PFPeA | | 101 | 20-150 | H | 97 | 20-150 | | 84 | 20-150 |
| 13C6-PFDA | | 87 | 20-150 | H | 82 | 20-150 | M-03 | 75 | 20-150 |
| 13C7-PFUnA | | 83 | 20-150 | HM-03 | 77 | 20-150 | | 60 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | H | 75 | 20-150 | M-03 | 69 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 | HM-03 | 81 | 20-150 | | 62 | 20-150 |
| 13C8-PFOSA | | 108 | 20-150 | H | 86 | 20-150 | | 62 | 20-150 |
| 13C9-PFNA | | 106 | 20-150 | H | 78 | 20-150 | | 70 | 20-150 |
| D3-NMeFOSA | | 91 | 20-150 | H | 67 | 20-150 | | 51 | 20-150 |
| D3-NMeFOSAA | | 105 | 20-150 | H | 79 | 20-150 | | 58 | 20-150 |
| D5-NEtFOSA | | 86 | 20-150 | H | 69 | 20-150 | | 52 | 20-150 |
| D5-NEtFOSAA | | 101 | 20-150 | HM-03 | 70 | 20-150 | | 51 | 20-150 |
| D7-NMeFOSE | | 95 | 20-150 | H | 74 | 20-150 | | 60 | 20-150 |
| D9-NEtFOSE | | 86 | 20-150 | H | 73 | 20-150 | | 59 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-003
Description: CMT-VRTB-01_4_01222024 | Matrix: Aqueous
Date Sampled: 01/22/2024 1700 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2001 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/21/2024 2229 | BWS | 02/20/2024 1023 | 96772 |
| 3 | 1633 | 1633 | 5 | 02/24/2024 1843 | ARC2 | 02/20/2024 1023 | 96772 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.3 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.3 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.2 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | U | 20 | 7.5 | 3.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 1.9 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 22 | U | 24 | 22 | 9.9 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 4.8 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.63 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.8 | U | 49 | 9.8 | 3.0 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.4 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.8 | U | 49 | 9.8 | 3.1 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.4 | U | 9.8 | 6.4 | 2.8 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.4 | U | 9.8 | 5.4 | 1.8 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.1 | U | 9.8 | 3.1 | 0.90 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.4 | U | 9.8 | 6.4 | 1.9 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 13 | | 4.9 | 1.7 | 0.46 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 9.6 | J | 20 | 8.0 | 2.5 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.80 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.66 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.75 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.52 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 19 | M-03 | 4.9 | 1.9 | 0.93 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 25 | | 4.9 | 3.9 | 1.0 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 530 | M-03 | 4.9 | 3.6 | 0.90 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 24 | | 4.9 | 2.0 | 0.69 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.71 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 9.6 | M-03 | 4.9 | 2.0 | 0.50 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.97 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1500 | M-03 | 4.9 | 3.6 | 1.2 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 52 | M-03 | 4.9 | 3.9 | 1.0 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 16 | | 4.9 | 3.7 | 1.3 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 15 | | 9.8 | 2.0 | 0.90 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.9 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.3 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.95 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.2 | ng/L | 3 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-003
Description: CMT-VRTB-01_4_01222024
Matrix: Aqueous
Date Sampled: 01/22/2024 1700
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 | H | 136 | 20-150 | | 79 | 20-150 |
| 13C2-6:2FTS | | 86 | 20-150 | H | 94 | 20-150 | | 67 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | HM-03 | 96 | 20-150 | M-03 | 74 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 | H | 63 | 20-150 | | 57 | 20-150 |
| 13C2-PFTeDA | | 71 | 20-150 | H | 63 | 20-150 | | 57 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | H | 69 | 20-150 | | 78 | 20-150 |
| 13C3-PFBS | | 94 | 20-150 | H | 94 | 20-150 | | 75 | 20-150 |
| 13C3-PFHxS | | 87 | 20-150 | H | 88 | 20-150 | | 80 | 20-150 |
| 13C4-PFBA | | 92 | 20-150 | H | 80 | 20-150 | | 78 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | H | 56 | 20-150 | | 77 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 | H | 63 | 20-150 | | 79 | 20-150 |
| 13C5-PFPeA | | 101 | 20-150 | H | 97 | 20-150 | | 84 | 20-150 |
| 13C6-PFDA | | 87 | 20-150 | H | 82 | 20-150 | M-03 | 75 | 20-150 |
| 13C7-PFUnA | | 83 | 20-150 | HM-03 | 77 | 20-150 | | 60 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | H | 75 | 20-150 | M-03 | 69 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 | HM-03 | 81 | 20-150 | | 62 | 20-150 |
| 13C8-PFOSA | | 108 | 20-150 | H | 86 | 20-150 | | 62 | 20-150 |
| 13C9-PFNA | | 106 | 20-150 | H | 78 | 20-150 | | 70 | 20-150 |
| D3-NMeFOSA | | 91 | 20-150 | H | 67 | 20-150 | | 51 | 20-150 |
| D3-NMeFOSAA | | 105 | 20-150 | H | 79 | 20-150 | | 58 | 20-150 |
| D5-NEtFOSA | | 86 | 20-150 | H | 69 | 20-150 | | 52 | 20-150 |
| D5-NEtFOSAA | | 101 | 20-150 | HM-03 | 70 | 20-150 | | 51 | 20-150 |
| D7-NMeFOSE | | 95 | 20-150 | H | 74 | 20-150 | | 60 | 20-150 |
| D9-NEtFOSE | | 86 | 20-150 | H | 73 | 20-150 | | 59 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-004
Description: CMT-VRTB-01_5_01222024 | Matrix: Aqueous
Date Sampled: 01/22/2024 1735 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2010 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/21/2024 2245 | BWS | 02/20/2024 1023 | 96772 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | UL | 3.8 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | UL | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | UL | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | UL | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | UL | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.4 | UL | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | UL | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | UL | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UL | 9.6 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UL | 9.6 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UL | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | UL | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | UL | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UL | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 12 | L | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 10 | L | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | UL | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | UL | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 9.9 | LM-03 | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 11 | L | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | UL | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 280 | LM-03 | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 17 | L | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | UL | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 2.2 | LM-03 | 0.96 | 0.38 | 0.098 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 320 | BLM-03 | 0.96 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 29 | LM-03 | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 14 | L | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 12 | L | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | UL | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-004
Description: CMT-VRTB-01_5_01222024
Matrix: Aqueous
Date Sampled: 01/22/2024 1735
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 83 | 20-150 | H | 135 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 | H | 114 | 20-150 |
| 13C2-8:2FTS | | 81 | 20-150 | H | 78 | 20-150 |
| 13C2-PFDoA | | 76 | 20-150 | H | 67 | 20-150 |
| 13C2-PFTeDA | | 68 | 20-150 | H | 61 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 | H | 77 | 20-150 |
| 13C3-PFBS | | 89 | 20-150 | H | 120 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | H | 97 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | H | 85 | 20-150 |
| 13C4-PFHpA | | 90 | 20-150 | H | 69 | 20-150 |
| 13C5-PFHxA | | 92 | 20-150 | H | 77 | 20-150 |
| 13C5-PFPeA | | 95 | 20-150 | H | 100 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | HM-03 | 82 | 20-150 |
| 13C7-PFUnA | | 76 | 20-150 | H | 66 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOS | | 91 | 20-150 | H | 81 | 20-150 |
| 13C8-PFOSA | | 93 | 20-150 | H | 72 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | H | 92 | 20-150 |
| D3-NMeFOSA | | 82 | 20-150 | H | 57 | 20-150 |
| D3-NMeFOSAA | | 98 | 20-150 | HM-03 | 77 | 20-150 |
| D5-NEtFOSA | | 82 | 20-150 | H | 59 | 20-150 |
| D5-NEtFOSAA | | 87 | 20-150 | H | 70 | 20-150 |
| D7-NMeFOSE | | 90 | 20-150 | H | 64 | 20-150 |
| D9-NEtFOSE | | 80 | 20-150 | H | 65 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-004
Description: CMT-VRTB-01_5_01222024 | Matrix: Aqueous
Date Sampled: 01/22/2024 1735 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2010 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/21/2024 2245 | BWS | 02/20/2024 1023 | 96772 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | UH | 3.8 | 2.2 | 0.84 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | UH | 3.8 | 2.1 | 0.64 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | UH | 3.8 | 2.2 | 0.64 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | UHL | 3.8 | 1.4 | 0.58 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | UH | 3.8 | 1.4 | 0.38 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.4 | UH | 4.8 | 4.4 | 1.9 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | UH | 24 | 9.6 | 4.1 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | UH | 3.8 | 2.3 | 0.95 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | UH | 0.96 | 0.38 | 0.12 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | UH | 0.96 | 0.77 | 0.28 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UH | 9.6 | 1.9 | 0.59 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | UH | 0.96 | 0.77 | 0.21 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | UH | 0.96 | 0.77 | 0.28 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UH | 9.6 | 1.9 | 0.60 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UH | 1.9 | 1.2 | 0.55 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | UH | 1.9 | 1.0 | 0.35 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | UH | 1.9 | 0.61 | 0.18 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UH | 1.9 | 1.2 | 0.37 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 12 | HM-03 | 0.96 | 0.34 | 0.090 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 12 | HM-03 | 3.8 | 1.5 | 0.49 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | UH | 0.96 | 0.37 | 0.16 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | UH | 0.96 | 0.38 | 0.13 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | UH | 0.96 | 0.37 | 0.15 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | UH | 0.96 | 0.38 | 0.10 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 11 | H | 0.96 | 0.36 | 0.18 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 17 | HM-03 | 0.96 | 0.77 | 0.20 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | UH | 24 | 9.6 | 4.0 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 260 | HM-03 | 0.96 | 0.70 | 0.18 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 21 | HM-03 | 0.96 | 0.38 | 0.14 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | UH | 0.96 | 0.36 | 0.14 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 2.0 | H | 0.96 | 0.38 | 0.099 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.38 | UH | 0.96 | 0.38 | 0.19 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 380 | HM-03 | 0.96 | 0.71 | 0.24 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 27 | H | 0.96 | 0.77 | 0.20 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 15 | HM-03 | 0.96 | 0.72 | 0.25 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 14 | H | 1.9 | 0.38 | 0.18 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | UH | 4.8 | 1.9 | 0.57 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | UH | 0.96 | 0.77 | 0.26 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | UH | 0.96 | 0.38 | 0.19 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | UH | 0.96 | 0.77 | 0.24 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-004
Description: CMT-VRTB-01_5_01222024
Matrix: Aqueous
Date Sampled: 01/22/2024 1735
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 83 | 20-150 | H | 135 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 | H | 114 | 20-150 |
| 13C2-8:2FTS | | 81 | 20-150 | H | 78 | 20-150 |
| 13C2-PFDoA | | 76 | 20-150 | H | 67 | 20-150 |
| 13C2-PFTeDA | | 68 | 20-150 | H | 61 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 | H | 77 | 20-150 |
| 13C3-PFBS | | 89 | 20-150 | H | 120 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | H | 97 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | H | 85 | 20-150 |
| 13C4-PFHpA | | 90 | 20-150 | H | 69 | 20-150 |
| 13C5-PFHxA | | 92 | 20-150 | H | 77 | 20-150 |
| 13C5-PFPeA | | 95 | 20-150 | H | 100 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | HM-03 | 82 | 20-150 |
| 13C7-PFUnA | | 76 | 20-150 | H | 66 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOS | | 91 | 20-150 | H | 81 | 20-150 |
| 13C8-PFOSA | | 93 | 20-150 | H | 72 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | H | 92 | 20-150 |
| D3-NMeFOSA | | 82 | 20-150 | H | 57 | 20-150 |
| D3-NMeFOSAA | | 98 | 20-150 | HM-03 | 77 | 20-150 |
| D5-NEtFOSA | | 82 | 20-150 | H | 59 | 20-150 |
| D5-NEtFOSAA | | 87 | 20-150 | H | 70 | 20-150 |
| D7-NMeFOSE | | 90 | 20-150 | H | 64 | 20-150 |
| D9-NEtFOSE | | 80 | 20-150 | H | 65 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-005
Description: CMT-VRTB-01_6_01222024 | Matrix: Aqueous
Date Sampled: 01/22/2024 1805 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2019 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/21/2024 2302 | BWS | 02/20/2024 1023 | 96772 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | UL | 3.5 | 2.0 | 0.76 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | UL | 3.5 | 1.9 | 0.58 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | UL | 3.5 | 2.0 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.3 | UL | 3.5 | 1.3 | 0.53 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | UL | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | UL | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | UL | 22 | 8.8 | 3.7 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | UL | 3.5 | 2.1 | 0.87 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | UL | 0.87 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | UL | 0.87 | 0.70 | 0.25 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.7 | UL | 8.7 | 1.7 | 0.53 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | UL | 0.87 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | UL | 0.87 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.7 | UL | 8.7 | 1.7 | 0.55 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.1 | UL | 1.7 | 1.1 | 0.50 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.94 | UL | 1.7 | 0.94 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.54 | UL | 1.7 | 0.54 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.1 | UL | 1.7 | 1.1 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.8 | L | 0.87 | 0.30 | 0.082 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 9.7 | L | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | UL | 0.87 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.35 | UL | 0.87 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | UL | 0.87 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | UL | 0.87 | 0.35 | 0.093 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 8.0 | LM-03 | 0.87 | 0.33 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 9.1 | L | 0.87 | 0.70 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | UL | 22 | 8.8 | 3.6 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 190 | LM-03 | 0.87 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 18 | L | 0.87 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.33 | UL | 0.87 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.2 | LM-03 | 0.87 | 0.35 | 0.090 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.35 | UL | 0.87 | 0.35 | 0.17 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 320 | BLM-03 | 0.87 | 0.64 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 18 | LM-03 | 0.87 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 13 | L | 0.87 | 0.65 | 0.22 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 13 | L | 1.7 | 0.34 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | UL | 4.4 | 1.8 | 0.52 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | UL | 0.87 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | UL | 0.87 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | UL | 0.87 | 0.70 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-005
Description: CMT-VRTB-01_6_01222024 | Matrix: Aqueous
Date Sampled: 01/22/2024 1805 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 86 | 20-150 | H | 73 | 20-150 |
| 13C2-6:2FTS | | 92 | 20-150 | H | 99 | 20-150 |
| 13C2-8:2FTS | | 77 | 20-150 | HM-03 | 64 | 20-150 |
| 13C2-PFDoA | | 79 | 20-150 | H | 53 | 20-150 |
| 13C2-PFTeDA | | 74 | 20-150 | H | 52 | 20-150 |
| 13C3-HFPO-DA | | 96 | 20-150 | H | 70 | 20-150 |
| 13C3-PFBS | | 88 | 20-150 | H | 70 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | HM-03 | 87 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 | H | 75 | 20-150 |
| 13C4-PFHpA | | 94 | 20-150 | H | 67 | 20-150 |
| 13C5-PFHxA | | 96 | 20-150 | H | 70 | 20-150 |
| 13C5-PFPeA | | 104 | 20-150 | H | 93 | 20-150 |
| 13C6-PFDA | | 90 | 20-150 | H | 63 | 20-150 |
| 13C7-PFUnA | | 87 | 20-150 | H | 57 | 20-150 |
| 13C8-PFOA | | 81 | 20-150 | H | 60 | 20-150 |
| 13C8-PFOS | | 89 | 20-150 | H | 65 | 20-150 |
| 13C8-PFOSA | | 91 | 20-150 | H | 58 | 20-150 |
| 13C9-PFNA | | 80 | 20-150 | H | 71 | 20-150 |
| D3-NMeFOSA | | 79 | 20-150 | H | 47 | 20-150 |
| D3-NMeFOSAA | | 100 | 20-150 | H | 58 | 20-150 |
| D5-NEtFOSA | | 81 | 20-150 | H | 50 | 20-150 |
| D5-NEtFOSAA | | 84 | 20-150 | H | 49 | 20-150 |
| D7-NMeFOSE | | 88 | 20-150 | H | 55 | 20-150 |
| D9-NEtFOSE | | 80 | 20-150 | H | 54 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-005
Description: CMT-VRTB-01_6_01222024 | Matrix: Aqueous
Date Sampled: 01/22/2024 1805 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2019 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/21/2024 2302 | BWS | 02/20/2024 1023 | 96772 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | UH | 3.6 | 2.1 | 0.78 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | UH | 3.6 | 2.0 | 0.60 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | UH | 3.6 | 2.1 | 0.59 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | UHL | 3.6 | 1.4 | 0.54 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | UH | 3.6 | 1.4 | 0.35 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | UH | 4.4 | 4.0 | 1.8 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | UH | 22 | 8.8 | 3.8 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | UH | 3.6 | 2.2 | 0.88 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.11 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.26 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UH | 8.9 | 1.8 | 0.54 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.19 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.26 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | UH | 8.9 | 1.8 | 0.56 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UH | 1.8 | 1.2 | 0.51 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | UH | 1.8 | 0.99 | 0.32 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | UH | 1.8 | 0.58 | 0.16 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UH | 1.8 | 1.2 | 0.35 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 12 | HM-03 | 0.89 | 0.31 | 0.083 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 12 | H | 3.6 | 1.4 | 0.45 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | UH | 0.89 | 0.35 | 0.15 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.12 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | UH | 0.89 | 0.35 | 0.14 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.095 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 11 | H | 0.89 | 0.34 | 0.17 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 12 | H | 0.89 | 0.71 | 0.19 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | UH | 22 | 8.8 | 3.7 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 150 | H | 0.89 | 0.65 | 0.16 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 21 | HM-03 | 0.89 | 0.36 | 0.13 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | UH | 0.89 | 0.34 | 0.13 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.1 | HM-03 | 0.89 | 0.36 | 0.092 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.18 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 460 | HM-03 | 0.89 | 0.66 | 0.22 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 17 | HM-03 | 0.89 | 0.71 | 0.19 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 11 | H | 0.89 | 0.67 | 0.23 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 15 | H | 1.8 | 0.36 | 0.16 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | UH | 4.4 | 1.8 | 0.53 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.24 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.17 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.22 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-005
Description: CMT-VRTB-01_6_01222024
Matrix: Aqueous
Date Sampled: 01/22/2024 1805
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 86 | 20-150 | H | 73 | 20-150 |
| 13C2-6:2FTS | | 92 | 20-150 | H | 99 | 20-150 |
| 13C2-8:2FTS | | 77 | 20-150 | HM-03 | 64 | 20-150 |
| 13C2-PFDoA | | 79 | 20-150 | H | 53 | 20-150 |
| 13C2-PFTeDA | | 74 | 20-150 | H | 52 | 20-150 |
| 13C3-HFPO-DA | | 96 | 20-150 | H | 70 | 20-150 |
| 13C3-PFBS | | 88 | 20-150 | H | 70 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | HM-03 | 87 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 | H | 75 | 20-150 |
| 13C4-PFHpA | | 94 | 20-150 | H | 67 | 20-150 |
| 13C5-PFHxA | | 96 | 20-150 | H | 70 | 20-150 |
| 13C5-PFPeA | | 104 | 20-150 | H | 93 | 20-150 |
| 13C6-PFDA | | 90 | 20-150 | H | 63 | 20-150 |
| 13C7-PFUnA | | 87 | 20-150 | H | 57 | 20-150 |
| 13C8-PFOA | | 81 | 20-150 | H | 60 | 20-150 |
| 13C8-PFOS | | 89 | 20-150 | H | 65 | 20-150 |
| 13C8-PFOSA | | 91 | 20-150 | H | 58 | 20-150 |
| 13C9-PFNA | | 80 | 20-150 | H | 71 | 20-150 |
| D3-NMeFOSA | | 79 | 20-150 | H | 47 | 20-150 |
| D3-NMeFOSAA | | 100 | 20-150 | H | 58 | 20-150 |
| D5-NEtFOSA | | 81 | 20-150 | H | 50 | 20-150 |
| D5-NEtFOSAA | | 84 | 20-150 | H | 49 | 20-150 |
| D7-NMeFOSE | | 88 | 20-150 | H | 55 | 20-150 |
| D9-NEtFOSE | | 80 | 20-150 | H | 54 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-006
Description: VRTB-D-P8_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 0855 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2028 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/22/2024 1158 | ALM | 02/19/2024 1132 | 96699 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | UL | 3.9 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | UL | 3.9 | 2.1 | 0.65 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | UL | 3.9 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | UL | 3.9 | 1.5 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | UL | 3.9 | 1.5 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.4 | UL | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | UL | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | UL | 3.9 | 2.3 | 0.96 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQL | 9.6 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQL | 9.6 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UL | 1.9 | 1.2 | 0.56 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | UL | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | UL | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UL | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.0 | L | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 14 | L | 3.9 | 1.6 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | UL | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | UL | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 3.6 | L | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 23 | L | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | UL | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 130 | LM-03 | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 24 | L | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | UL | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 5.8 | LM-03 | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 260 | BLM-03 | 0.96 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 20 | LM-03 | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 4.6 | LM-03 | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 23 | L | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | UL | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | UQL | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | UL | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | UL | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-006
Description: VRTB-D-P8_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 0855
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 87 | 20-150 | | 66 | 20-150 |
| 13C2-6:2FTS | | 85 | 20-150 | | 69 | 20-150 |
| 13C2-8:2FTS | | 74 | 20-150 | | 63 | 20-150 |
| 13C2-PFDoA | | 54 | 20-150 | | 67 | 20-150 |
| 13C2-PFTeDA | M-03N | 16 | 20-150 | | 62 | 20-150 |
| 13C3-HFPO-DA | | 101 | 20-150 | | 77 | 20-150 |
| 13C3-PFBS | | 89 | 20-150 | | 74 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 | | 67 | 20-150 |
| 13C4-PFBA | | 98 | 20-150 | N | 8.0 | 20-150 |
| 13C4-PFHpA | | 98 | 20-150 | | 75 | 20-150 |
| 13C5-PFHxA | | 97 | 20-150 | | 73 | 20-150 |
| 13C5-PFPeA | | 109 | 20-150 | | 65 | 20-150 |
| 13C6-PFDA | | 76 | 20-150 | | 68 | 20-150 |
| 13C7-PFUnA | | 68 | 20-150 | | 65 | 20-150 |
| 13C8-PFOA | | 100 | 20-150 | | 78 | 20-150 |
| 13C8-PFOS | | 85 | 20-150 | | 71 | 20-150 |
| 13C8-PFOSA | | 89 | 20-150 | | 68 | 20-150 |
| 13C9-PFNA | | 88 | 20-150 | | 68 | 20-150 |
| D3-NMeFOSA | | 67 | 20-150 | | 63 | 20-150 |
| D3-NMeFOSAA | | 81 | 20-150 | | 70 | 20-150 |
| D5-NEtFOSA | | 55 | 20-150 | | 61 | 20-150 |
| D5-NEtFOSAA | | 70 | 20-150 | | 68 | 20-150 |
| D7-NMeFOSE | N | 4.0 | 20-150 | | 60 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | | 59 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-006
Description: VRTB-D-P8_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 0855 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2028 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/22/2024 1158 | ALM | 02/19/2024 1132 | 96699 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.4 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.3 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | U | 20 | 7.5 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | U | 25 | 23 | 10 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 5.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.64 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | U | 50 | 10 | 3.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | U | 50 | 10 | 3.2 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | U | 10 | 6.5 | 2.9 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | U | 10 | 5.5 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | U | 10 | 3.2 | 0.92 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | U | 10 | 6.5 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.5 | M-03 | 5.0 | 1.8 | 0.47 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 18 | JQ | 20 | 8.0 | 2.6 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.82 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.68 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.77 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.53 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 2.2 | JM-03 | 5.0 | 1.9 | 0.95 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 27 | M-03 | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 150 | M-03 | 5.0 | 3.7 | 0.92 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 28 | | 5.0 | 2.0 | 0.71 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 5.0 | 1.9 | 0.73 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 6.8 | M-03 | 5.0 | 2.0 | 0.52 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.99 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 280 | M-03 | 5.0 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 22 | | 5.0 | 4.0 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 4.6 | JM-03 | 5.0 | 3.8 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 28 | | 10 | 2.0 | 0.92 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | U | 25 | 10 | 3.0 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.97 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-006
Description: VRTB-D-P8_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 0855
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 87 | 20-150 | | 66 | 20-150 |
| 13C2-6:2FTS | | 85 | 20-150 | | 69 | 20-150 |
| 13C2-8:2FTS | | 74 | 20-150 | | 63 | 20-150 |
| 13C2-PFDoA | | 54 | 20-150 | | 67 | 20-150 |
| 13C2-PFTeDA | M-03N | 16 | 20-150 | | 62 | 20-150 |
| 13C3-HFPO-DA | | 101 | 20-150 | | 77 | 20-150 |
| 13C3-PFBS | | 89 | 20-150 | | 74 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 | | 67 | 20-150 |
| 13C4-PFBA | | 98 | 20-150 | N | 8.0 | 20-150 |
| 13C4-PFHpA | | 98 | 20-150 | | 75 | 20-150 |
| 13C5-PFHxA | | 97 | 20-150 | | 73 | 20-150 |
| 13C5-PFPeA | | 109 | 20-150 | | 65 | 20-150 |
| 13C6-PFDA | | 76 | 20-150 | | 68 | 20-150 |
| 13C7-PFUnA | | 68 | 20-150 | | 65 | 20-150 |
| 13C8-PFOA | | 100 | 20-150 | | 78 | 20-150 |
| 13C8-PFOS | | 85 | 20-150 | | 71 | 20-150 |
| 13C8-PFOSA | | 89 | 20-150 | | 68 | 20-150 |
| 13C9-PFNA | | 88 | 20-150 | | 68 | 20-150 |
| D3-NMeFOSA | | 67 | 20-150 | | 63 | 20-150 |
| D3-NMeFOSAA | | 81 | 20-150 | | 70 | 20-150 |
| D5-NEtFOSA | | 55 | 20-150 | | 61 | 20-150 |
| D5-NEtFOSAA | | 70 | 20-150 | | 68 | 20-150 |
| D7-NMeFOSE | N | 4.0 | 20-150 | | 60 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | | 59 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-007
Description: VRTB-D-R7_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 0950 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 2 | 1633 | 1633 | 1 | 02/22/2024 1207 | ALM | 02/19/2024 1132 | 96699 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.4 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.3 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | U | 20 | 7.5 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | U | 25 | 23 | 10 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 5.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.64 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | U | 50 | 10 | 3.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | U | 50 | 10 | 3.2 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | U | 10 | 6.5 | 2.9 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | U | 10 | 5.5 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | U | 10 | 3.2 | 0.92 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | U | 10 | 6.5 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.6 | | 5.0 | 1.8 | 0.47 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 10 | J | 20 | 8.0 | 2.6 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.82 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.68 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.77 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.53 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.3 | JM-03 | 5.0 | 1.9 | 0.95 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 16 | M-03 | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 72 | M-03 | 5.0 | 3.7 | 0.92 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 17 | | 5.0 | 2.0 | 0.71 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 5.0 | 1.9 | 0.73 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.5 | J | 5.0 | 2.0 | 0.52 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.99 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 98 | M-03 | 5.0 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 10 | M-03 | 5.0 | 4.0 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 1.9 | J | 5.0 | 3.8 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 17 | | 10 | 2.0 | 0.92 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | U | 25 | 10 | 3.0 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.97 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-007
Description: VRTB-D-R7_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 0950
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 72 | 20-150 |
| 13C2-6:2FTS | | 75 | 20-150 |
| 13C2-8:2FTS | | 77 | 20-150 |
| 13C2-PFDoA | | 69 | 20-150 |
| 13C2-PFTeDA | | 63 | 20-150 |
| 13C3-HFPO-DA | | 76 | 20-150 |
| 13C3-PFBS | | 79 | 20-150 |
| 13C3-PFHxS | | 79 | 20-150 |
| 13C4-PFBA | | 76 | 20-150 |
| 13C4-PFHpA | | 76 | 20-150 |
| 13C5-PFHxA | | 73 | 20-150 |
| 13C5-PFPeA | | 75 | 20-150 |
| 13C6-PFDA | | 63 | 20-150 |
| 13C7-PFUnA | | 75 | 20-150 |
| 13C8-PFOA | | 86 | 20-150 |
| 13C8-PFOS | | 74 | 20-150 |
| 13C8-PFOSA | | 70 | 20-150 |
| 13C9-PFNA | | 69 | 20-150 |
| D3-NMeFOSA | | 52 | 20-150 |
| D3-NMeFOSAA | | 73 | 20-150 |
| D5-NEtFOSA | | 52 | 20-150 |
| D5-NEtFOSAA | | 68 | 20-150 |
| D7-NMeFOSE | | 59 | 20-150 |
| D9-NEtFOSE | | 56 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-008
Description: VRTB-D-06_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 1040 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 2 | 1633 | 1633 | 1 | 02/22/2024 1216 | ALM | 02/19/2024 1132 | 96699 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.4 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.3 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | U | 20 | 7.5 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | U | 25 | 23 | 10 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 5.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.64 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | U | 50 | 10 | 3.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | U | 50 | 10 | 3.2 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | U | 10 | 6.5 | 2.9 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | U | 10 | 5.5 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | U | 10 | 3.2 | 0.92 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | U | 10 | 6.5 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 3.1 | JM-03 | 5.0 | 1.8 | 0.47 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.2 | J | 20 | 8.0 | 2.6 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.82 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.68 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.77 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.53 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 7.8 | M-03 | 5.0 | 1.9 | 0.95 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 6.7 | M-03 | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 120 | M-03 | 5.0 | 3.7 | 0.92 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 11 | M-03 | 5.0 | 2.0 | 0.71 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 5.0 | 1.9 | 0.73 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.4 | JM-03 | 5.0 | 2.0 | 0.52 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.99 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 310 | M-03 | 5.0 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 10 | M-03 | 5.0 | 4.0 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 5.7 | | 5.0 | 3.8 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 7.0 | J | 10 | 2.0 | 0.92 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | U | 25 | 10 | 3.0 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.97 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-008
Description: VRTB-D-06_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 1040
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 78 | 20-150 |
| 13C2-6:2FTS | | 71 | 20-150 |
| 13C2-8:2FTS | | 71 | 20-150 |
| 13C2-PFDoA | | 67 | 20-150 |
| 13C2-PFTeDA | | 59 | 20-150 |
| 13C3-HFPO-DA | | 77 | 20-150 |
| 13C3-PFBS | | 82 | 20-150 |
| 13C3-PFHxS | | 73 | 20-150 |
| 13C4-PFBA | | 77 | 20-150 |
| 13C4-PFHpA | | 74 | 20-150 |
| 13C5-PFHxA | | 73 | 20-150 |
| 13C5-PFPeA | | 74 | 20-150 |
| 13C6-PFDA | | 70 | 20-150 |
| 13C7-PFUnA | | 66 | 20-150 |
| 13C8-PFOA | | 76 | 20-150 |
| 13C8-PFOS | | 75 | 20-150 |
| 13C8-PFOSA | | 73 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 |
| D3-NMeFOSA | | 52 | 20-150 |
| D3-NMeFOSAA | | 74 | 20-150 |
| D5-NEtFOSA | | 51 | 20-150 |
| D5-NEtFOSAA | | 74 | 20-150 |
| D7-NMeFOSE | | 62 | 20-150 |
| D9-NEtFOSE | | 61 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-009
Description: VRTB-D-M5_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 1130 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 2 | 1633 | 1633 | 1 | 02/22/2024 1225 | ALM | 02/19/2024 1132 | 96699 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.4 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.3 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | U | 20 | 7.5 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | U | 25 | 23 | 10 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 5.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.64 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | U | 50 | 10 | 3.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | U | 50 | 10 | 3.2 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | U | 10 | 6.5 | 2.9 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | U | 10 | 5.5 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | U | 10 | 3.2 | 0.92 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | U | 10 | 6.5 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 3.3 | JM-03 | 5.0 | 1.8 | 0.47 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 7.7 | J | 20 | 8.0 | 2.6 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.82 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.68 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.77 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.53 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 3.8 | J | 5.0 | 1.9 | 0.95 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 6.6 | M-03 | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 87 | M-03 | 5.0 | 3.7 | 0.92 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 11 | | 5.0 | 2.0 | 0.71 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 5.0 | 1.9 | 0.73 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.3 | JM-03 | 5.0 | 2.0 | 0.52 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.99 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 290 | M-03 | 5.0 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 8.5 | M-03 | 5.0 | 4.0 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 4.5 | J | 5.0 | 3.8 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 2.0 | U | 10 | 2.0 | 0.92 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | U | 25 | 10 | 3.0 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.97 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-009
Description: VRTB-D-M5_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 1130
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 77 | 20-150 |
| 13C2-6:2FTS | | 78 | 20-150 |
| 13C2-8:2FTS | | 73 | 20-150 |
| 13C2-PFDoA | | 81 | 20-150 |
| 13C2-PFTeDA | | 74 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 |
| 13C3-PFBS | | 86 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 |
| 13C4-PFHpA | | 87 | 20-150 |
| 13C5-PFHxA | | 85 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 |
| 13C7-PFUnA | | 84 | 20-150 |
| 13C8-PFOA | | 87 | 20-150 |
| 13C8-PFOS | | 85 | 20-150 |
| 13C8-PFOSA | | 83 | 20-150 |
| 13C9-PFNA | | 80 | 20-150 |
| D3-NMeFOSA | | 62 | 20-150 |
| D3-NMeFOSAA | | 84 | 20-150 |
| D5-NEtFOSA | | 60 | 20-150 |
| D5-NEtFOSAA | M-03 | 79 | 20-150 |
| D7-NMeFOSE | | 67 | 20-150 |
| D9-NEtFOSE | | 66 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-010
Description: VRTB-S-G4_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 1255 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 2 | 1633 | 1633 | 1 | 02/24/2024 1349 | ARC2 | 02/19/2024 1630 | 96753 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.4 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.3 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | U | 20 | 7.5 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | U | 25 | 23 | 10 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 5.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.64 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | U | 50 | 10 | 3.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | U | 50 | 10 | 3.2 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | U | 10 | 6.5 | 2.9 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | U | 10 | 5.5 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | U | 10 | 3.2 | 0.92 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | U | 10 | 6.5 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 7.1 | M-03 | 5.0 | 1.8 | 0.47 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 5.4 | J | 20 | 8.0 | 2.6 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.82 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.68 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.77 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.53 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 14 | | 5.0 | 1.9 | 0.95 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 6.3 | | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 290 | M-03 | 5.0 | 3.7 | 0.92 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 12 | | 5.0 | 2.0 | 0.71 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 5.0 | 1.9 | 0.73 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.57 | JM-03 | 5.0 | 2.0 | 0.52 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.99 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 800 | M-03 | 5.0 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 9.8 | | 5.0 | 4.0 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 13 | | 5.0 | 3.8 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 7.6 | JM-03 | 10 | 2.0 | 0.92 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | U | 25 | 10 | 3.0 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.97 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-010
Description: VRTB-S-G4_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 1255
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 80 | 20-150 |
| 13C2-6:2FTS | | 82 | 20-150 |
| 13C2-8:2FTS | | 82 | 20-150 |
| 13C2-PFDoA | | 69 | 20-150 |
| 13C2-PFTeDA | | 47 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 |
| 13C3-PFBS | | 88 | 20-150 |
| 13C3-PFHxS | | 87 | 20-150 |
| 13C4-PFBA | | 86 | 20-150 |
| 13C4-PFHpA | | 90 | 20-150 |
| 13C5-PFHxA | | 91 | 20-150 |
| 13C5-PFPeA | | 92 | 20-150 |
| 13C6-PFDA | | 87 | 20-150 |
| 13C7-PFUnA | | 76 | 20-150 |
| 13C8-PFOA | | 77 | 20-150 |
| 13C8-PFOS | | 86 | 20-150 |
| 13C8-PFOSA | | 85 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 |
| D3-NMeFOSA | | 64 | 20-150 |
| D3-NMeFOSAA | | 79 | 20-150 |
| D5-NEtFOSA | | 59 | 20-150 |
| D5-NEtFOSAA | | 72 | 20-150 |
| D7-NMeFOSE | | 71 | 20-150 |
| D9-NEtFOSE | | 63 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-011
Description: VRTB-S-Y3_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 1410 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 2 | 1633 | 1633 | 1 | 02/21/2024 2318 | BWS | 02/20/2024 1023 | 96772 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.4 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.3 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | UL | 20 | 7.5 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 2.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | U | 25 | 23 | 10 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 5.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.64 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | U | 50 | 10 | 3.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | U | 50 | 10 | 3.2 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | U | 10 | 6.5 | 2.9 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | U | 10 | 5.5 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | U | 10 | 3.2 | 0.92 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | U | 10 | 6.5 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.6 | | 5.0 | 1.8 | 0.47 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 13 | J | 20 | 8.0 | 2.6 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.82 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.68 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.77 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.53 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 35 | M-03 | 5.0 | 1.9 | 0.95 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 15 | | 5.0 | 4.0 | 1.1 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | U | 130 | 52 | 21 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 530 | M-03 | 5.0 | 3.7 | 0.92 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 25 | M-03 | 5.0 | 2.0 | 0.71 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 5.0 | 1.9 | 0.73 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 3.9 | JM-03 | 5.0 | 2.0 | 0.52 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.99 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1300 | M-03 | 5.0 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 28 | | 5.0 | 4.0 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 13 | | 5.0 | 3.8 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 16 | | 10 | 2.0 | 0.92 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | U | 25 | 10 | 3.0 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 5.0 | 2.0 | 0.97 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | U | 5.0 | 4.0 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-011
Description: VRTB-S-Y3_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 1410
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 |
| 13C2-6:2FTS | | 82 | 20-150 |
| 13C2-8:2FTS | | 76 | 20-150 |
| 13C2-PFDoA | | 56 | 20-150 |
| 13C2-PFTeDA | | 36 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 |
| 13C3-PFBS | | 79 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 |
| 13C5-PFHxA | | 103 | 20-150 |
| 13C5-PFPeA | | 126 | 20-150 |
| 13C6-PFDA | M-03 | 68 | 20-150 |
| 13C7-PFUnA | | 66 | 20-150 |
| 13C8-PFOA | | 84 | 20-150 |
| 13C8-PFOS | | 73 | 20-150 |
| 13C8-PFOSA | | 70 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 |
| D3-NMeFOSA | | 56 | 20-150 |
| D3-NMeFOSAA | | 61 | 20-150 |
| D5-NEtFOSA | | 51 | 20-150 |
| D5-NEtFOSAA | | 54 | 20-150 |
| D7-NMeFOSE | | 42 | 20-150 |
| D9-NEtFOSE | | 24 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-012
Description: VRTB-S-S2_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 1510 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2150 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/21/2024 2334 | BWS | 02/20/2024 1023 | 96772 |
| 3 | 1633 | 1633 | 5 | 02/23/2024 0018 | BWS | 02/20/2024 1023 | 96772 |
| 4 | 1633 | 1633 | 1 | 02/27/2024 2254 | ARC2 | 02/26/2024 1200 | 97189 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | UL | 3.5 | 2.0 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | UL | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | UL | 3.5 | 2.0 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | JL | 3.5 | 1.3 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | UL | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | UL | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | UL | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | UL | 3.5 | 2.1 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | UL | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | UL | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UL | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | UL | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | UL | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | UL | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UL | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | UL | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | UL | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UL | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.0 | L | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 16 | L | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | UL | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | UL | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | UL | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | UL | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 12 | LM-03 | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 21 | L | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | UL | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 160 | LM-03 | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 23 | L | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.29 | JLM-03 | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 20 | L | 0.89 | 0.36 | 0.091 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.1 | LM-03 | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 770 | BELM-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 39 | LM-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 7.9 | L | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 22 | L | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | UL | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | UL | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | UL | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | UL | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-012
Description: VRTB-S-S2_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 1510
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 2 Q | Run 2 % Recovery | Run 3 Q | Run 3 % Recovery | Run 4 Q | Run 4 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 94 | | 101 | | 69 | H | 89 | 20-150 |
| 13C2-6:2FTS | | 89 | | 80 | | 62 | H | 88 | 20-150 |
| 13C2-8:2FTS | | 75 | | 57 | | 51 | H | 86 | 20-150 |
| 13C2-PFDoA | | 68 | M-03 | 34 | | 37 | H | 81 | 20-150 |
| 13C2-PFTeDA | | 51 | N | 4.0 | M-03N | 5.0 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 98 | | 74 | | 56 | H | 92 | 20-150 |
| 13C3-PFBS | | 97 | | 64 | | 68 | H | 87 | 20-150 |
| 13C3-PFHxS | | 95 | | 56 | | 84 | H | 87 | 20-150 |
| 13C4-PFBA | | 96 | | 66 | | 66 | H | 85 | 20-150 |
| 13C4-PFHpA | | 97 | | 62 | | 57 | H | 87 | 20-150 |
| 13C5-PFHxA | | 99 | | 74 | | 62 | H | 86 | 20-150 |
| 13C5-PFPeA | | 107 | | 89 | | 83 | H | 92 | 20-150 |
| 13C6-PFDA | | 88 | | 53 | | 62 | H | 84 | 20-150 |
| 13C7-PFUnA | | 78 | | 48 | | 56 | H | 83 | 20-150 |
| 13C8-PFOA | | 95 | | 65 | | 58 | H | 86 | 20-150 |
| 13C8-PFOS | | 78 | | 53 | M-03 | 64 | H | 81 | 20-150 |
| 13C8-PFOSA | | 75 | | 48 | | 59 | H | 92 | 20-150 |
| 13C9-PFNA | | 91 | M-03 | 50 | | 58 | H | 84 | 20-150 |
| D3-NMeFOSA | | 60 | | 38 | | 42 | H | 67 | 20-150 |
| D3-NMeFOSAA | | 86 | M-03 | 57 | | 79 | H | 83 | 20-150 |
| D5-NEtFOSA | | 59 | | 32 | | 40 | H | 65 | 20-150 |
| D5-NEtFOSAA | | 76 | M-03 | 38 | M-03 | 49 | H | 94 | 20-150 |
| D7-NMeFOSE | | 52 | N | 1.0 | N | 2.0 | H | 74 | 20-150 |
| D9-NEtFOSE | | 31 | N | 1.0 | N | 1.0 | H | 72 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-012
Description: VRTB-S-S2_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 1510 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2150 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/21/2024 2334 | BWS | 02/20/2024 1023 | 96772 |
| 3 | 1633 | 1633 | 5 | 02/23/2024 0018 | BWS | 02/20/2024 1023 | 96772 |
| 4 | 1633 | 1633 | 1 | 02/27/2024 2254 | ARC2 | 02/26/2024 1200 | 97189 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.86 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.65 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.65 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | UL | 3.9 | 1.5 | 0.60 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.39 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.5 | U | 4.9 | 4.5 | 2.0 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.2 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.97 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.13 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.28 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | UQ | 9.8 | 2.0 | 0.60 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.21 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.29 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | UQ | 9.8 | 2.0 | 0.62 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.56 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.35 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.38 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.5 | | 0.98 | 0.34 | 0.092 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 19 | | 3.9 | 1.6 | 0.50 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | U | 0.98 | 0.38 | 0.16 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.13 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | U | 0.98 | 0.38 | 0.15 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.10 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 14 | M-03 | 0.98 | 0.37 | 0.19 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 28 | | 0.98 | 0.78 | 0.21 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 180 | | 0.98 | 0.72 | 0.18 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 23 | M-03 | 0.98 | 0.39 | 0.14 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.37 | U | 0.98 | 0.37 | 0.14 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 25 | M-03 | 0.98 | 0.39 | 0.10 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.19 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 0.73 | U | 0.98 | 0.73 | 0.24 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 38 | M-03 | 0.98 | 0.78 | 0.20 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 8.0 | | 0.98 | 0.74 | 0.25 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 29 | | 2.0 | 0.40 | 0.18 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.58 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | UQ | 0.98 | 0.78 | 0.26 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.19 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.24 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-012
Description: VRTB-S-S2_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 1510
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 2 Q | Run 2 % Recovery | Run 3 Q | Run 3 % Recovery | Run 4 Q | Run 4 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 94 | | 101 | | 69 | H | 89 | 20-150 |
| 13C2-6:2FTS | | 89 | | 80 | | 62 | H | 88 | 20-150 |
| 13C2-8:2FTS | | 75 | | 57 | | 51 | H | 86 | 20-150 |
| 13C2-PFDoA | | 68 | M-03 | 34 | | 37 | H | 81 | 20-150 |
| 13C2-PFTeDA | | 51 | N | 4.0 | M-03N | 5.0 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 98 | | 74 | | 56 | H | 92 | 20-150 |
| 13C3-PFBS | | 97 | | 64 | | 68 | H | 87 | 20-150 |
| 13C3-PFHxS | | 95 | | 56 | | 84 | H | 87 | 20-150 |
| 13C4-PFBA | | 96 | | 66 | | 66 | H | 85 | 20-150 |
| 13C4-PFHpA | | 97 | | 62 | | 57 | H | 87 | 20-150 |
| 13C5-PFHxA | | 99 | | 74 | | 62 | H | 86 | 20-150 |
| 13C5-PFPeA | | 107 | | 89 | | 83 | H | 92 | 20-150 |
| 13C6-PFDA | | 88 | | 53 | | 62 | H | 84 | 20-150 |
| 13C7-PFUnA | | 78 | | 48 | | 56 | H | 83 | 20-150 |
| 13C8-PFOA | | 95 | | 65 | | 58 | H | 86 | 20-150 |
| 13C8-PFOS | | 78 | | 53 | M-03 | 64 | H | 81 | 20-150 |
| 13C8-PFOSA | | 75 | | 48 | | 59 | H | 92 | 20-150 |
| 13C9-PFNA | | 91 | M-03 | 50 | | 58 | H | 84 | 20-150 |
| D3-NMeFOSA | | 60 | | 38 | | 42 | H | 67 | 20-150 |
| D3-NMeFOSAA | | 86 | M-03 | 57 | | 79 | H | 83 | 20-150 |
| D5-NEtFOSA | | 59 | | 32 | | 40 | H | 65 | 20-150 |
| D5-NEtFOSAA | | 76 | M-03 | 38 | M-03 | 49 | H | 94 | 20-150 |
| D7-NMeFOSE | | 52 | N | 1.0 | N | 2.0 | H | 74 | 20-150 |
| D9-NEtFOSE | | 31 | N | 1.0 | N | 1.0 | H | 72 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-012
Description: VRTB-S-S2_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 1510 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2150 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/21/2024 2334 | BWS | 02/20/2024 1023 | 96772 |
| 3 | 1633 | 1633 | 5 | 02/23/2024 0018 | BWS | 02/20/2024 1023 | 96772 |
| 4 | 1633 | 1633 | 1 | 02/27/2024 2254 | ARC2 | 02/26/2024 1200 | 97189 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.3 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.3 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.2 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | UL | 20 | 7.5 | 3.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 1.9 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 22 | U | 24 | 22 | 9.9 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 4.9 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.63 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.8 | UQ | 49 | 9.8 | 3.0 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.4 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.8 | UQ | 49 | 9.8 | 3.1 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.4 | U | 9.8 | 6.4 | 2.8 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.4 | U | 9.8 | 5.4 | 1.8 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.1 | U | 9.8 | 3.1 | 0.90 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.4 | U | 9.8 | 6.4 | 1.9 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 3.4 | JM-03 | 4.9 | 1.7 | 0.46 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 18 | J | 20 | 8.0 | 2.5 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.80 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.66 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.75 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.52 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 9.2 | M-03 | 4.9 | 1.9 | 0.93 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 26 | | 4.9 | 3.9 | 1.0 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 110 | | 4.9 | 3.6 | 0.90 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 29 | | 4.9 | 2.0 | 0.69 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.71 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 21 | | 4.9 | 2.0 | 0.50 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.97 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 830 | M-03 | 4.9 | 3.6 | 1.2 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 47 | M-03 | 4.9 | 3.9 | 1.0 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 5.6 | | 4.9 | 3.7 | 1.3 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 24 | | 9.8 | 2.0 | 0.90 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.9 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.9 | UQ | 4.9 | 3.9 | 1.3 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.95 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.2 | ng/L | 3 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-012
Description: VRTB-S-S2_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 1510
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 2 Q | Run 2 % Recovery | Run 3 Q | Run 3 % Recovery | Run 4 Q | Run 4 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 94 | | 101 | | 69 | H | 89 | 20-150 |
| 13C2-6:2FTS | | 89 | | 80 | | 62 | H | 88 | 20-150 |
| 13C2-8:2FTS | | 75 | | 57 | | 51 | H | 86 | 20-150 |
| 13C2-PFDoA | | 68 | M-03 | 34 | | 37 | H | 81 | 20-150 |
| 13C2-PFTeDA | | 51 | N | 4.0 | M-03N | 5.0 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 98 | | 74 | | 56 | H | 92 | 20-150 |
| 13C3-PFBS | | 97 | | 64 | | 68 | H | 87 | 20-150 |
| 13C3-PFHxS | | 95 | | 56 | | 84 | H | 87 | 20-150 |
| 13C4-PFBA | | 96 | | 66 | | 66 | H | 85 | 20-150 |
| 13C4-PFHpA | | 97 | | 62 | | 57 | H | 87 | 20-150 |
| 13C5-PFHxA | | 99 | | 74 | | 62 | H | 86 | 20-150 |
| 13C5-PFPeA | | 107 | | 89 | | 83 | H | 92 | 20-150 |
| 13C6-PFDA | | 88 | | 53 | | 62 | H | 84 | 20-150 |
| 13C7-PFUnA | | 78 | | 48 | | 56 | H | 83 | 20-150 |
| 13C8-PFOA | | 95 | | 65 | | 58 | H | 86 | 20-150 |
| 13C8-PFOS | | 78 | | 53 | M-03 | 64 | H | 81 | 20-150 |
| 13C8-PFOSA | | 75 | | 48 | | 59 | H | 92 | 20-150 |
| 13C9-PFNA | | 91 | M-03 | 50 | | 58 | H | 84 | 20-150 |
| D3-NMeFOSA | | 60 | | 38 | | 42 | H | 67 | 20-150 |
| D3-NMeFOSAA | | 86 | M-03 | 57 | | 79 | H | 83 | 20-150 |
| D5-NEtFOSA | | 59 | | 32 | | 40 | H | 65 | 20-150 |
| D5-NEtFOSAA | | 76 | M-03 | 38 | M-03 | 49 | H | 94 | 20-150 |
| D7-NMeFOSE | | 52 | N | 1.0 | N | 2.0 | H | 74 | 20-150 |
| D9-NEtFOSE | | 31 | N | 1.0 | N | 1.0 | H | 72 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-012
Description: VRTB-S-S2_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 1510 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/15/2024 2150 | ARC2 | 02/12/2024 1531 | 96299 |
| 2 | 1633 | 1633 | 1 | 02/21/2024 2334 | BWS | 02/20/2024 1023 | 96772 |
| 3 | 1633 | 1633 | 5 | 02/23/2024 0018 | BWS | 02/20/2024 1023 | 96772 |
| 4 | 1633 | 1633 | 1 | 02/27/2024 2254 | ARC2 | 02/26/2024 1200 | 97189 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | UH | 20 | 12 | 4.4 | ng/L | 4 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | UH | 20 | 11 | 3.3 | ng/L | 4 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | UH | 20 | 12 | 3.3 | ng/L | 4 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | UHL | 20 | 7.5 | 3.0 | ng/L | 4 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | UHL | 20 | 7.5 | 2.0 | ng/L | 4 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | UHL | 25 | 23 | 10 | ng/L | 4 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | UH | 130 | 52 | 21 | ng/L | 4 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | UH | 20 | 12 | 5.0 | ng/L | 4 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | UHL | 5.0 | 2.0 | 0.64 | ng/L | 4 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | UHL | 5.0 | 4.0 | 1.5 | ng/L | 4 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | UHL | 50 | 10 | 3.1 | ng/L | 4 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | UHL | 5.0 | 4.0 | 1.1 | ng/L | 4 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | UHL | 5.0 | 4.0 | 1.5 | ng/L | 4 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | UHL | 50 | 10 | 3.2 | ng/L | 4 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | UH | 10 | 6.5 | 2.9 | ng/L | 4 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | UH | 10 | 5.5 | 1.8 | ng/L | 4 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | UH | 10 | 3.2 | 0.92 | ng/L | 4 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | UH | 10 | 6.5 | 1.9 | ng/L | 4 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 4.4 | HJL | 5.0 | 1.8 | 0.47 | ng/L | 4 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 15 | HJL | 20 | 8.0 | 2.6 | ng/L | 4 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | UHL | 5.0 | 2.0 | 0.82 | ng/L | 4 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | UHL | 5.0 | 2.0 | 0.68 | ng/L | 4 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | UHL | 5.0 | 2.0 | 0.77 | ng/L | 4 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | UHL | 5.0 | 2.0 | 0.53 | ng/L | 4 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 10 | HL | 5.0 | 1.9 | 0.95 | ng/L | 4 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 24 | HLM-03 | 5.0 | 4.0 | 1.1 | ng/L | 4 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | UH | 130 | 52 | 21 | ng/L | 4 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 140 | HLM-03 | 5.0 | 3.7 | 0.92 | ng/L | 4 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 24 | HL | 5.0 | 2.0 | 0.71 | ng/L | 4 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | UHL | 5.0 | 1.9 | 0.73 | ng/L | 4 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 19 | HL | 5.0 | 2.0 | 0.52 | ng/L | 4 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | UHLM-03 | 5.0 | 2.0 | 0.99 | ng/L | 4 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 650 | BHL | 5.0 | 3.7 | 1.2 | ng/L | 4 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 42 | HLM-03 | 5.0 | 4.0 | 1.0 | ng/L | 4 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 6.5 | HL | 5.0 | 3.8 | 1.3 | ng/L | 4 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 23 | HL | 10 | 2.0 | 0.92 | ng/L | 4 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | UH | 25 | 10 | 3.0 | ng/L | 4 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | UHL | 5.0 | 4.0 | 1.3 | ng/L | 4 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | UHL | 5.0 | 2.0 | 0.97 | ng/L | 4 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | UHL | 5.0 | 4.0 | 1.2 | ng/L | 4 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-012
Description: VRTB-S-S2_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 1510
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Run 1 Q | Run 1 % Recovery | Run 2 Q | Run 2 % Recovery | Run 3 Q | Run 3 % Recovery | Run 4 Q | Run 4 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 94 | | 101 | | 69 | H | 89 | 20-150 |
| 13C2-6:2FTS | | 89 | | 80 | | 62 | H | 88 | 20-150 |
| 13C2-8:2FTS | | 75 | | 57 | | 51 | H | 86 | 20-150 |
| 13C2-PFDoA | | 68 | M-03 | 34 | | 37 | H | 81 | 20-150 |
| 13C2-PFTeDA | | 51 | N | 4.0 | M-03N | 5.0 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 98 | | 74 | | 56 | H | 92 | 20-150 |
| 13C3-PFBS | | 97 | | 64 | | 68 | H | 87 | 20-150 |
| 13C3-PFHxS | | 95 | | 56 | | 84 | H | 87 | 20-150 |
| 13C4-PFBA | | 96 | | 66 | | 66 | H | 85 | 20-150 |
| 13C4-PFHpA | | 97 | | 62 | | 57 | H | 87 | 20-150 |
| 13C5-PFHxA | | 99 | | 74 | | 62 | H | 86 | 20-150 |
| 13C5-PFPeA | | 107 | | 89 | | 83 | H | 92 | 20-150 |
| 13C6-PFDA | | 88 | | 53 | | 62 | H | 84 | 20-150 |
| 13C7-PFUnA | | 78 | | 48 | | 56 | H | 83 | 20-150 |
| 13C8-PFOA | | 95 | | 65 | | 58 | H | 86 | 20-150 |
| 13C8-PFOS | | 78 | | 53 | M-03 | 64 | H | 81 | 20-150 |
| 13C8-PFOSA | | 75 | | 48 | | 59 | H | 92 | 20-150 |
| 13C9-PFNA | | 91 | M-03 | 50 | | 58 | H | 84 | 20-150 |
| D3-NMeFOSA | | 60 | | 38 | | 42 | H | 67 | 20-150 |
| D3-NMeFOSAA | | 86 | M-03 | 57 | | 79 | H | 83 | 20-150 |
| D5-NEtFOSA | | 59 | | 32 | | 40 | H | 65 | 20-150 |
| D5-NEtFOSAA | | 76 | M-03 | 38 | M-03 | 49 | H | 94 | 20-150 |
| D7-NMeFOSE | | 52 | N | 1.0 | N | 2.0 | H | 74 | 20-150 |
| D9-NEtFOSE | | 31 | N | 1.0 | N | 1.0 | H | 72 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-013
Description: VRTB-S-B1_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 1610 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0604 | BWS | 02/13/2024 1406 | 96346 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.83 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.63 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.3 | U | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.94 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.4 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.4 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 2.3 | | 0.94 | 0.33 | 0.089 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 4.8 | | 3.8 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.2 | | 0.94 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 2.1 | | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 30 | | 0.94 | 0.69 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 4.6 | | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.94 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.097 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 110 | B | 0.94 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 1.9 | M-03 | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 1.6 | | 0.94 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 4.2 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.56 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-013
Description: VRTB-S-B1_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 1610
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 |
| 13C2-6:2FTS | | 81 | 20-150 |
| 13C2-8:2FTS | | 80 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 |
| 13C2-PFTeDA | | 34 | 20-150 |
| 13C3-HFPO-DA | | 86 | 20-150 |
| 13C3-PFBS | | 87 | 20-150 |
| 13C3-PFHxS | | 88 | 20-150 |
| 13C4-PFBA | | 86 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 |
| 13C5-PFHxA | | 86 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 |
| 13C7-PFUnA | | 66 | 20-150 |
| 13C8-PFOA | | 83 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 |
| 13C8-PFOSA | | 75 | 20-150 |
| 13C9-PFNA | | 81 | 20-150 |
| D3-NMeFOSA | | 54 | 20-150 |
| D3-NMeFOSAA | | 66 | 20-150 |
| D5-NEtFOSA | | 45 | 20-150 |
| D5-NEtFOSAA | | 51 | 20-150 |
| D7-NMeFOSE | | 47 | 20-150 |
| D9-NEtFOSE | | 26 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-014

Description: VRTB-L-BB8_01232024 | Matrix: Aqueous

Date Sampled: 01/23/2024 1700 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0623 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 5 | 02/20/2024 1523 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/23/2024 0455 | ALM | 02/21/2024 1208 | 96883 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 11 | | 3.6 | 1.4 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 52 | | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UQ | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | UQ | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 18 | | 0.89 | 0.31 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 79 | | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 190 | | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 170 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1400 | E | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 230 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 49 | M-03 | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.97 | QM-03 | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 9700 | BEM-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 200 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 64 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 190 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-014

Description: VRTB-L-BB8_01232024 | Matrix: Aqueous

Date Sampled: 01/23/2024 1700 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 133 | 20-150 | | 94 | 20-150 | H | 77 | 20-150 |
| 13C2-6:2FTS | | 112 | 20-150 | | 92 | 20-150 | HM-03 | 65 | 20-150 |
| 13C2-8:2FTS | | 103 | 20-150 | | 91 | 20-150 | HM-03 | 71 | 20-150 |
| 13C2-PFDoA | | 69 | 20-150 | | 46 | 20-150 | H | 75 | 20-150 |
| 13C2-PFTeDA | | 22 | 20-150 | M-03 | 28 | 20-150 | H | 70 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | | 100 | 20-150 | H | 75 | 20-150 |
| 13C3-PFBS | | 126 | 20-150 | | 101 | 20-150 | H | 83 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 | | 87 | 20-150 | H | 76 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 | M-03 | 90 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 91 | 20-150 | | 96 | 20-150 | H | 78 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 | | 96 | 20-150 | H | 79 | 20-150 |
| 13C5-PFPeA | | 95 | 20-150 | | 90 | 20-150 | H | 80 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | | 78 | 20-150 | H | 76 | 20-150 |
| 13C7-PFUnA | | 83 | 20-150 | | 72 | 20-150 | H | 72 | 20-150 |
| 13C8-PFOA | | 76 | 20-150 | | 96 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOS | M-03 | 88 | 20-150 | | 88 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOSA | N | 205 | 20-150 | | 117 | 20-150 | H | 76 | 20-150 |
| 13C9-PFNA | | 77 | 20-150 | | 82 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 139 | 20-150 | | 84 | 20-150 | H | 60 | 20-150 |
| D3-NMeFOSAA | | 138 | 20-150 | | 87 | 20-150 | H | 80 | 20-150 |
| D5-NEtFOSA | | 118 | 20-150 | | 75 | 20-150 | H | 62 | 20-150 |
| D5-NEtFOSAA | | 80 | 20-150 | | 62 | 20-150 | H | 80 | 20-150 |
| D7-NMeFOSE | M-03N | 10 | 20-150 | | 99 | 20-150 | H | 69 | 20-150 |
| D9-NEtFOSE | N | 4.0 | 20-150 | | 88 | 20-150 | H | 68 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-014

Description: VRTB-L-BB8_01232024 | Matrix: Aqueous

Date Sampled: 01/23/2024 1700 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0623 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 5 | 02/20/2024 1523 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/23/2024 0455 | ALM | 02/21/2024 1208 | 96883 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 10 | U | 18 | 10 | 3.9 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 9.9 | U | 18 | 9.9 | 3.0 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 10 | U | 18 | 10 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 31 | | 18 | 6.8 | 2.7 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 6.8 | U | 18 | 6.8 | 1.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 110 | | 22 | 20 | 9.0 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 44 | U | 110 | 44 | 19 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 18 | 11 | 4.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.57 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.6 | U | 4.5 | 3.6 | 1.3 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.0 | U | 45 | 9.0 | 2.7 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.6 | U | 4.5 | 3.6 | 0.96 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.6 | U | 4.5 | 3.6 | 1.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.0 | U | 45 | 9.0 | 2.8 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 5.8 | U | 8.9 | 5.8 | 2.6 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 4.9 | U | 8.9 | 4.9 | 1.6 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 2.8 | U | 8.9 | 2.8 | 0.82 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 5.8 | U | 8.9 | 5.8 | 1.7 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 11 | | 4.5 | 1.6 | 0.42 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 58 | M-03 | 18 | 7.2 | 2.3 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.73 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.60 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.69 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.48 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 110 | | 4.5 | 1.7 | 0.85 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 150 | | 4.5 | 3.6 | 0.95 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 44 | U | 110 | 44 | 19 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1200 | | 4.5 | 3.3 | 0.82 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 170 | | 4.5 | 1.8 | 0.63 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.7 | U | 4.5 | 1.7 | 0.65 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 61 | M-03 | 4.5 | 1.8 | 0.46 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.1 | JM-03 | 4.5 | 1.8 | 0.89 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 13000 | BE | 4.5 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 210 | | 4.5 | 3.6 | 0.93 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 37 | | 4.5 | 3.4 | 1.1 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 140 | M-03 | 8.9 | 1.8 | 0.82 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 8.8 | U | 22 | 8.8 | 2.7 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.6 | U | 4.5 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.87 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.6 | U | 4.5 | 3.6 | 1.1 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-014

Description: VRTB-L-BB8_01232024 | Matrix: Aqueous

Date Sampled: 01/23/2024 1700 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 133 | 20-150 | | 94 | 20-150 | H | 77 | 20-150 |
| 13C2-6:2FTS | | 112 | 20-150 | | 92 | 20-150 | HM-03 | 65 | 20-150 |
| 13C2-8:2FTS | | 103 | 20-150 | | 91 | 20-150 | HM-03 | 71 | 20-150 |
| 13C2-PFDoA | | 69 | 20-150 | | 46 | 20-150 | H | 75 | 20-150 |
| 13C2-PFTeDA | | 22 | 20-150 | M-03 | 28 | 20-150 | H | 70 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | | 100 | 20-150 | H | 75 | 20-150 |
| 13C3-PFBS | | 126 | 20-150 | | 101 | 20-150 | H | 83 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 | | 87 | 20-150 | H | 76 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 | M-03 | 90 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 91 | 20-150 | | 96 | 20-150 | H | 78 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 | | 96 | 20-150 | H | 79 | 20-150 |
| 13C5-PFPeA | | 95 | 20-150 | | 90 | 20-150 | H | 80 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | | 78 | 20-150 | H | 76 | 20-150 |
| 13C7-PFUnA | | 83 | 20-150 | | 72 | 20-150 | H | 72 | 20-150 |
| 13C8-PFOA | | 76 | 20-150 | | 96 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOS | M-03 | 88 | 20-150 | | 88 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOSA | N | 205 | 20-150 | | 117 | 20-150 | H | 76 | 20-150 |
| 13C9-PFNA | | 77 | 20-150 | | 82 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 139 | 20-150 | | 84 | 20-150 | H | 60 | 20-150 |
| D3-NMeFOSAA | | 138 | 20-150 | | 87 | 20-150 | H | 80 | 20-150 |
| D5-NEtFOSA | | 118 | 20-150 | | 75 | 20-150 | H | 62 | 20-150 |
| D5-NEtFOSAA | | 80 | 20-150 | | 62 | 20-150 | H | 80 | 20-150 |
| D7-NMeFOSE | M-03N | 10 | 20-150 | | 99 | 20-150 | H | 69 | 20-150 |
| D9-NEtFOSE | N | 4.0 | 20-150 | | 88 | 20-150 | H | 68 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-014

Description: VRTB-L-BB8_01232024 | Matrix: Aqueous

Date Sampled: 01/23/2024 1700 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0623 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 5 | 02/20/2024 1523 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/23/2024 0455 | ALM | 02/21/2024 1208 | 96883 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 75 | UH | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 230 | UH | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 23 | HJ | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 98 | HJ | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 84 | H | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 210 | H | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1900 | HM-03 | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 280 | H | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 58 | HM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 14000 | HM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 240 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 61 | HM-03 | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 220 | H | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-014

Description: VRTB-L-BB8_01232024 | Matrix: Aqueous

Date Sampled: 01/23/2024 1700 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 133 | 20-150 | | 94 | 20-150 | H | 77 | 20-150 |
| 13C2-6:2FTS | | 112 | 20-150 | | 92 | 20-150 | HM-03 | 65 | 20-150 |
| 13C2-8:2FTS | | 103 | 20-150 | | 91 | 20-150 | HM-03 | 71 | 20-150 |
| 13C2-PFDoA | | 69 | 20-150 | | 46 | 20-150 | H | 75 | 20-150 |
| 13C2-PFTeDA | | 22 | 20-150 | M-03 | 28 | 20-150 | H | 70 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | | 100 | 20-150 | H | 75 | 20-150 |
| 13C3-PFBS | | 126 | 20-150 | | 101 | 20-150 | H | 83 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 | | 87 | 20-150 | H | 76 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 | M-03 | 90 | 20-150 | H | 77 | 20-150 |
| 13C4-PFHpA | | 91 | 20-150 | | 96 | 20-150 | H | 78 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 | | 96 | 20-150 | H | 79 | 20-150 |
| 13C5-PFPeA | | 95 | 20-150 | | 90 | 20-150 | H | 80 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | | 78 | 20-150 | H | 76 | 20-150 |
| 13C7-PFUnA | | 83 | 20-150 | | 72 | 20-150 | H | 72 | 20-150 |
| 13C8-PFOA | | 76 | 20-150 | | 96 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOS | M-03 | 88 | 20-150 | | 88 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOSA | N | 205 | 20-150 | | 117 | 20-150 | H | 76 | 20-150 |
| 13C9-PFNA | | 77 | 20-150 | | 82 | 20-150 | H | 74 | 20-150 |
| D3-NMeFOSA | | 139 | 20-150 | | 84 | 20-150 | H | 60 | 20-150 |
| D3-NMeFOSAA | | 138 | 20-150 | | 87 | 20-150 | H | 80 | 20-150 |
| D5-NEtFOSA | | 118 | 20-150 | | 75 | 20-150 | H | 62 | 20-150 |
| D5-NEtFOSAA | | 80 | 20-150 | | 62 | 20-150 | H | 80 | 20-150 |
| D7-NMeFOSE | M-03N | 10 | 20-150 | | 99 | 20-150 | H | 69 | 20-150 |
| D9-NEtFOSE | N | 4.0 | 20-150 | | 88 | 20-150 | H | 68 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-015
Description: VRTB-L-P7_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 1745 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0700 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 5 | 02/20/2024 1541 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/23/2024 0201 | ALM | 02/21/2024 1208 | 96883 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.85 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.65 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.65 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 38 | | 3.9 | 1.5 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 120 | | 4.9 | 4.5 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.97 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.7 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQ | 9.7 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.56 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 13 | | 0.97 | 0.34 | 0.091 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 61 | | 3.9 | 1.6 | 0.50 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 200 | | 0.97 | 0.37 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 160 | | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1300 | E | 0.97 | 0.71 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 190 | | 0.97 | 0.39 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.37 | U | 0.97 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 63 | M-03 | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.8 | QM-03 | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 11000 | BEM-03 | 0.97 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 210 | | 0.97 | 0.78 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 53 | | 0.97 | 0.73 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 160 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.7 | JM-03 | 4.9 | 2.0 | 0.58 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-015
Description: VRTB-L-P7_01232024 | Matrix: Aqueous
Date Sampled: 01/23/2024 1745 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 145 | 20-150 | | 94 | 20-150 | H | 81 | 20-150 |
| 13C2-6:2FTS | | 122 | 20-150 | | 90 | 20-150 | H | 91 | 20-150 |
| 13C2-8:2FTS | | 105 | 20-150 | | 86 | 20-150 | H | 80 | 20-150 |
| 13C2-PFDoA | | 52 | 20-150 | | 51 | 20-150 | H | 78 | 20-150 |
| 13C2-PFTeDA | M-03 | 35 | 20-150 | M-03N | 19 | 20-150 | H | 84 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | | 94 | 20-150 | H | 87 | 20-150 |
| 13C3-PFBS | | 116 | 20-150 | | 94 | 20-150 | H | 94 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | | 83 | 20-150 | H | 90 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 | | 87 | 20-150 | H | 83 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | | 86 | 20-150 | H | 82 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 94 | 20-150 | H | 85 | 20-150 |
| 13C5-PFPeA | | 94 | 20-150 | | 87 | 20-150 | H | 84 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 | | 78 | 20-150 | H | 86 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 | | 71 | 20-150 | H | 79 | 20-150 |
| 13C8-PFOA | | 96 | 20-150 | | 77 | 20-150 | H | 94 | 20-150 |
| 13C8-PFOS | | 83 | 20-150 | M-03 | 88 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOSA | N | 198 | 20-150 | | 124 | 20-150 | H | 89 | 20-150 |
| 13C9-PFNA | | 87 | 20-150 | | 74 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 138 | 20-150 | | 90 | 20-150 | H | 68 | 20-150 |
| D3-NMeFOSAA | | 136 | 20-150 | | 94 | 20-150 | H | 93 | 20-150 |
| D5-NEtFOSA | | 123 | 20-150 | | 77 | 20-150 | H | 70 | 20-150 |
| D5-NEtFOSAA | | 73 | 20-150 | | 70 | 20-150 | H | 90 | 20-150 |
| D7-NMeFOSE | N | 173 | 20-150 | N | 6.0 | 20-150 | H | 79 | 20-150 |
| D9-NEtFOSE | | 145 | 20-150 | N | 2.0 | 20-150 | H | 78 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-015

Description: VRTB-L-P7_01232024 | Matrix: Aqueous

Date Sampled: 01/23/2024 1745 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0700 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 5 | 02/20/2024 1541 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/23/2024 0201 | ALM | 02/21/2024 1208 | 96883 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.3 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.3 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.2 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.6 | J | 19 | 7.1 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 50 | | 24 | 22 | 9.8 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.63 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.8 | UQ | 49 | 9.8 | 3.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.8 | UQ | 49 | 9.8 | 3.1 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.3 | U | 9.7 | 6.3 | 2.8 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.3 | U | 9.7 | 5.3 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.1 | U | 9.7 | 3.1 | 0.90 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.3 | U | 9.7 | 6.3 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 19 | | 4.9 | 1.7 | 0.46 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 88 | M-03 | 19 | 7.6 | 2.5 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.80 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.66 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.75 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.52 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 130 | | 4.9 | 1.9 | 0.93 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 190 | | 4.9 | 3.9 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1600 | | 4.9 | 3.6 | 0.90 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 260 | | 4.9 | 2.0 | 0.69 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.71 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 52 | | 4.9 | 2.0 | 0.50 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | UM-03 | 4.9 | 2.0 | 0.97 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 13000 | BE | 4.9 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 210 | | 4.9 | 3.9 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 53 | | 4.9 | 3.7 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 210 | | 9.7 | 1.9 | 0.90 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.9 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.9 | UQ | 4.9 | 3.9 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.95 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-015
Description: VRTB-L-P7_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 1745
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 145 | 20-150 | | 94 | 20-150 | H | 81 | 20-150 |
| 13C2-6:2FTS | | 122 | 20-150 | | 90 | 20-150 | H | 91 | 20-150 |
| 13C2-8:2FTS | | 105 | 20-150 | | 86 | 20-150 | H | 80 | 20-150 |
| 13C2-PFDoA | | 52 | 20-150 | | 51 | 20-150 | H | 78 | 20-150 |
| 13C2-PFTeDA | M-03 | 35 | 20-150 | M-03N | 19 | 20-150 | H | 84 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | | 94 | 20-150 | H | 87 | 20-150 |
| 13C3-PFBS | | 116 | 20-150 | | 94 | 20-150 | H | 94 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | | 83 | 20-150 | H | 90 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 | | 87 | 20-150 | H | 83 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | | 86 | 20-150 | H | 82 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 94 | 20-150 | H | 85 | 20-150 |
| 13C5-PFPeA | | 94 | 20-150 | | 87 | 20-150 | H | 84 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 | | 78 | 20-150 | H | 86 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 | | 71 | 20-150 | H | 79 | 20-150 |
| 13C8-PFOA | | 96 | 20-150 | | 77 | 20-150 | H | 94 | 20-150 |
| 13C8-PFOS | | 83 | 20-150 | M-03 | 88 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOSA | N | 198 | 20-150 | | 124 | 20-150 | H | 89 | 20-150 |
| 13C9-PFNA | | 87 | 20-150 | | 74 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 138 | 20-150 | | 90 | 20-150 | H | 68 | 20-150 |
| D3-NMeFOSAA | | 136 | 20-150 | | 94 | 20-150 | H | 93 | 20-150 |
| D5-NEtFOSA | | 123 | 20-150 | | 77 | 20-150 | H | 70 | 20-150 |
| D5-NEtFOSAA | | 73 | 20-150 | | 70 | 20-150 | H | 90 | 20-150 |
| D7-NMeFOSE | N | 173 | 20-150 | N | 6.0 | 20-150 | H | 79 | 20-150 |
| D9-NEtFOSE | | 145 | 20-150 | N | 2.0 | 20-150 | H | 78 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-015

Description: VRTB-L-P7_01232024 | Matrix: Aqueous

Date Sampled: 01/23/2024 1745 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0700 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 5 | 02/20/2024 1541 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/23/2024 0201 | ALM | 02/21/2024 1208 | 96883 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 75 | UH | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 140 | HJM-03 | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 20 | HJM-03 | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 84 | HJ | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 95 | H | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 220 | H | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1700 | HM-03 | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 250 | H | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 75 | H | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 18000 | HM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 260 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 48 | HJ | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 190 | H | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-015
Description: VRTB-L-P7_01232024
Matrix: Aqueous
Date Sampled: 01/23/2024 1745
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 145 | 20-150 | | 94 | 20-150 | H | 81 | 20-150 |
| 13C2-6:2FTS | | 122 | 20-150 | | 90 | 20-150 | H | 91 | 20-150 |
| 13C2-8:2FTS | | 105 | 20-150 | | 86 | 20-150 | H | 80 | 20-150 |
| 13C2-PFDoA | | 52 | 20-150 | | 51 | 20-150 | H | 78 | 20-150 |
| 13C2-PFTeDA | M-03 | 35 | 20-150 | M-03N | 19 | 20-150 | H | 84 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | | 94 | 20-150 | H | 87 | 20-150 |
| 13C3-PFBS | | 116 | 20-150 | | 94 | 20-150 | H | 94 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | | 83 | 20-150 | H | 90 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 | | 87 | 20-150 | H | 83 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | | 86 | 20-150 | H | 82 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 94 | 20-150 | H | 85 | 20-150 |
| 13C5-PFPeA | | 94 | 20-150 | | 87 | 20-150 | H | 84 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 | | 78 | 20-150 | H | 86 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 | | 71 | 20-150 | H | 79 | 20-150 |
| 13C8-PFOA | | 96 | 20-150 | | 77 | 20-150 | H | 94 | 20-150 |
| 13C8-PFOS | | 83 | 20-150 | M-03 | 88 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOSA | N | 198 | 20-150 | | 124 | 20-150 | H | 89 | 20-150 |
| 13C9-PFNA | | 87 | 20-150 | | 74 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 138 | 20-150 | | 90 | 20-150 | H | 68 | 20-150 |
| D3-NMeFOSAA | | 136 | 20-150 | | 94 | 20-150 | H | 93 | 20-150 |
| D5-NEtFOSA | | 123 | 20-150 | | 77 | 20-150 | H | 70 | 20-150 |
| D5-NEtFOSAA | | 73 | 20-150 | | 70 | 20-150 | H | 90 | 20-150 |
| D7-NMeFOSE | N | 173 | 20-150 | N | 6.0 | 20-150 | H | 79 | 20-150 |
| D9-NEtFOSE | | 145 | 20-150 | N | 2.0 | 20-150 | H | 78 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-016
Description: VRTB-L-06_01242024 | Matrix: Aqueous
Date Sampled: 01/24/2024 0910 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0719 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 5 | 02/20/2024 1600 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/23/2024 0210 | ALM | 02/21/2024 1208 | 96883 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.82 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.63 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 61 | | 3.7 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 200 | | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.93 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | U | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | U | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.4 | | 0.94 | 0.33 | 0.088 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 50 | | 3.7 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 230 | | 0.94 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 170 | | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1300 | | 4.7 | 3.4 | 0.86 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 130 | | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.94 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 110 | M-03 | 0.94 | 0.38 | 0.097 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | U | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 19000 | M-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 270 | | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 32 | | 0.94 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 140 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.56 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-016

Description: VRTB-L-06_01242024 | Matrix: Aqueous

Date Sampled: 01/24/2024 0910 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 138 | 20-150 | | 94 | 20-150 | | 88 | 20-150 |
| 13C2-6:2FTS | | 104 | 20-150 | | 91 | 20-150 | | 94 | 20-150 |
| 13C2-8:2FTS | | 98 | 20-150 | | 82 | 20-150 | | 77 | 20-150 |
| 13C2-PFDoA | | 66 | 20-150 | | 58 | 20-150 | | 84 | 20-150 |
| 13C2-PFTeDA | | 38 | 20-150 | M-03 | 35 | 20-150 | | 97 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 | | 86 | 20-150 | | 96 | 20-150 |
| 13C3-PFBS | | 121 | 20-150 | | 97 | 20-150 | | 93 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | | 86 | 20-150 | | 97 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | M-03 | 89 | 20-150 | | 88 | 20-150 |
| 13C4-PFHpA | | 90 | 20-150 | | 88 | 20-150 | | 93 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 | | 86 | 20-150 | | 90 | 20-150 |
| 13C5-PFPeA | | 93 | 20-150 | | 85 | 20-150 | | 88 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 | | 90 | 20-150 | | 89 | 20-150 |
| 13C7-PFUnA | | 84 | 20-150 | | 81 | 20-150 | | 83 | 20-150 |
| 13C8-PFOA | | 87 | 20-150 | | 67 | 20-150 | | 90 | 20-150 |
| 13C8-PFOS | M-03 | 88 | 20-150 | | 84 | 20-150 | | 84 | 20-150 |
| 13C8-PFOSA | N | 213 | 20-150 | | 121 | 20-150 | | 92 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | | 92 | 20-150 | | 86 | 20-150 |
| D3-NMeFOSA | | 140 | 20-150 | | 81 | 20-150 | | 71 | 20-150 |
| D3-NMeFOSAA | | 142 | 20-150 | | 94 | 20-150 | | 91 | 20-150 |
| D5-NEtFOSA | | 123 | 20-150 | | 71 | 20-150 | | 74 | 20-150 |
| D5-NEtFOSAA | | 79 | 20-150 | | 62 | 20-150 | | 93 | 20-150 |
| D7-NMeFOSE | N | 8.0 | 20-150 | N | 5.0 | 20-150 | | 83 | 20-150 |
| D9-NEtFOSE | N | 3.0 | 20-150 | N | 2.0 | 20-150 | | 84 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-017

Description: VRTB-L-M5_01242024 | Matrix: Aqueous

Date Sampled: 01/24/2024 1005 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0737 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 5 | 02/20/2024 1618 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/23/2024 0219 | ALM | 02/21/2024 1208 | 96883 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 44 | | 3.8 | 1.4 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 110 | | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | UM-03 | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.3 | | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 34 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | J | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 160 | | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 110 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 850 | | 4.8 | 3.5 | 0.89 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 91 | | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 80 | M-03 | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 8.0 | U | 20 | 8.0 | 4.0 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 11000 | M-03 | 20 | 15 | 4.9 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 190 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 22 | | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 95 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-017

Description: VRTB-L-M5_01242024 | Matrix: Aqueous

Date Sampled: 01/24/2024 1005 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 131 | 20-150 | | 105 | 20-150 | | 88 | 20-150 |
| 13C2-6:2FTS | | 119 | 20-150 | | 94 | 20-150 | | 84 | 20-150 |
| 13C2-8:2FTS | | 90 | 20-150 | | 91 | 20-150 | | 77 | 20-150 |
| 13C2-PFDoA | M-03 | 65 | 20-150 | | 70 | 20-150 | | 81 | 20-150 |
| 13C2-PFTeDA | M-03 | 44 | 20-150 | M-03 | 40 | 20-150 | | 76 | 20-150 |
| 13C3-HFPO-DA | | 93 | 20-150 | | 94 | 20-150 | | 84 | 20-150 |
| 13C3-PFBS | | 117 | 20-150 | | 99 | 20-150 | | 91 | 20-150 |
| 13C3-PFHxS | | 88 | 20-150 | | 89 | 20-150 | | 88 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | M-03 | 92 | 20-150 | | 81 | 20-150 |
| 13C4-PFHpA | | 91 | 20-150 | | 95 | 20-150 | | 79 | 20-150 |
| 13C5-PFHxA | | 96 | 20-150 | | 95 | 20-150 | | 82 | 20-150 |
| 13C5-PFPeA | | 97 | 20-150 | | 89 | 20-150 | | 83 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 | | 99 | 20-150 | | 81 | 20-150 |
| 13C7-PFUnA | | 81 | 20-150 | | 85 | 20-150 | | 74 | 20-150 |
| 13C8-PFOA | | 92 | 20-150 | | 96 | 20-150 | | 79 | 20-150 |
| 13C8-PFOS | | 87 | 20-150 | | 87 | 20-150 | | 83 | 20-150 |
| 13C8-PFOSA | N | 180 | 20-150 | | 114 | 20-150 | | 88 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | | 87 | 20-150 | | 79 | 20-150 |
| D3-NMeFOSA | | 135 | 20-150 | | 85 | 20-150 | | 63 | 20-150 |
| D3-NMeFOSAA | | 135 | 20-150 | | 89 | 20-150 | | 85 | 20-150 |
| D5-NEtFOSA | | 112 | 20-150 | | 74 | 20-150 | | 61 | 20-150 |
| D5-NEtFOSAA | | 77 | 20-150 | | 61 | 20-150 | | 82 | 20-150 |
| D7-NMeFOSE | | 66 | 20-150 | | 44 | 20-150 | | 74 | 20-150 |
| D9-NEtFOSE | | 31 | 20-150 | | 20 | 20-150 | | 71 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-018
Description: VRTB-D-G4_01242024 | Matrix: Aqueous
Date Sampled: 01/24/2024 1135 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0756 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 1 | 02/23/2024 0228 | ALM | 02/21/2024 1208 | 96883 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | UQ | 3.9 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | UQ | 3.9 | 2.1 | 0.65 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | UQ | 3.9 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | UQ | 3.9 | 1.5 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | UQ | 3.9 | 1.5 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.4 | UQ | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | UQ | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | UQ | 3.9 | 2.3 | 0.96 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQ | 9.6 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQ | 9.6 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UQ | 1.9 | 1.2 | 0.56 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | UQ | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | UQ | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UQ | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 0.43 | JQ | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 6.0 | | 3.9 | 1.6 | 0.50 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | UQ | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | UQ | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | UQ | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.5 | M-03 | 0.97 | 0.37 | 0.19 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 4.6 | | 0.97 | 0.78 | 0.21 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | UQ | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 49 | M-03 | 0.97 | 0.71 | 0.18 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 16 | | 0.97 | 0.39 | 0.14 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | UQ | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.26 | JQM-03 | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.38 | UQ | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 130 | M-03 | 0.97 | 0.72 | 0.24 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 4.4 | M-03 | 0.97 | 0.78 | 0.20 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 2.0 | M-03 | 0.97 | 0.73 | 0.25 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 19 | | 1.9 | 0.38 | 0.18 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | UQ | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.26 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-018
Description: VRTB-D-G4_01242024
Matrix: Aqueous
Date Sampled: 01/24/2024 1135
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | N | 197 | 20-150 | | 87 | 20-150 |
| 13C2-6:2FTS | N | 168 | 20-150 | | 89 | 20-150 |
| 13C2-8:2FTS | N | 162 | 20-150 | | 72 | 20-150 |
| 13C2-PFDoA | | 75 | 20-150 | M-03 | 57 | 20-150 |
| 13C2-PFTeDA | M-03N | 12 | 20-150 | | 34 | 20-150 |
| 13C3-HFPO-DA | N | 188 | 20-150 | | 97 | 20-150 |
| 13C3-PFBS | N | 204 | 20-150 | | 94 | 20-150 |
| 13C3-PFHxS | N | 190 | 20-150 | | 95 | 20-150 |
| 13C4-PFBA | N | 190 | 20-150 | | 93 | 20-150 |
| 13C4-PFHpA | N | 192 | 20-150 | | 92 | 20-150 |
| 13C5-PFHxA | N | 191 | 20-150 | | 95 | 20-150 |
| 13C5-PFPeA | N | 205 | 20-150 | | 95 | 20-150 |
| 13C6-PFDA | N | 173 | 20-150 | | 92 | 20-150 |
| 13C7-PFUnA | | 140 | 20-150 | | 78 | 20-150 |
| 13C8-PFOA | N | 165 | 20-150 | | 102 | 20-150 |
| 13C8-PFOS | N | 175 | 20-150 | | 88 | 20-150 |
| 13C8-PFOSA | N | 167 | 20-150 | | 78 | 20-150 |
| 13C9-PFNA | N | 179 | 20-150 | | 89 | 20-150 |
| D3-NMeFOSA | | 115 | 20-150 | | 61 | 20-150 |
| D3-NMeFOSAA | | 116 | 20-150 | | 66 | 20-150 |
| D5-NEtFOSA | | 81 | 20-150 | | 55 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 | | 54 | 20-150 |
| D7-NMeFOSE | N | 2.0 | 20-150 | N | 15 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 7.0 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-019
Description: VRTB-D-Y3_01242024 | Matrix: Aqueous
Date Sampled: 01/24/2024 1245 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0815 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 1 | 02/23/2024 0237 | ALM | 02/21/2024 1208 | 96883 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.85 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.65 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.65 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.5 | U | 4.9 | 4.5 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.97 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.4 | 1.9 | 0.57 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.7 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.56 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 1.6 | | 0.97 | 0.34 | 0.091 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 2.5 | JM-03 | 3.9 | 1.6 | 0.50 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.4 | M-03 | 0.97 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 1.8 | | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 35 | | 0.97 | 0.71 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 2.7 | | 0.97 | 0.39 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.37 | U | 0.97 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.25 | JM-03 | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 60 | B | 0.97 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 2.8 | M-03 | 0.97 | 0.78 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 4.1 | | 0.97 | 0.73 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 1.9 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.58 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-019
Description: VRTB-D-Y3_01242024
Matrix: Aqueous
Date Sampled: 01/24/2024 1245
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 135 | 20-150 | | 86 | 20-150 |
| 13C2-6:2FTS | | 124 | 20-150 | | 84 | 20-150 |
| 13C2-8:2FTS | | 113 | 20-150 | | 78 | 20-150 |
| 13C2-PFDoA | M-03 | 67 | 20-150 | | 61 | 20-150 |
| 13C2-PFTeDA | M-03 | 43 | 20-150 | | 30 | 20-150 |
| 13C3-HFPO-DA | | 129 | 20-150 | | 86 | 20-150 |
| 13C3-PFBS | | 133 | 20-150 | | 94 | 20-150 |
| 13C3-PFHxS | | 131 | 20-150 | | 95 | 20-150 |
| 13C4-PFBA | | 128 | 20-150 | | 86 | 20-150 |
| 13C4-PFHpA | | 130 | 20-150 | | 88 | 20-150 |
| 13C5-PFHxA | | 133 | 20-150 | | 88 | 20-150 |
| 13C5-PFPeA | | 138 | 20-150 | | 86 | 20-150 |
| 13C6-PFDA | | 116 | 20-150 | | 85 | 20-150 |
| 13C7-PFUnA | M-03 | 95 | 20-150 | | 74 | 20-150 |
| 13C8-PFOA | | 120 | 20-150 | | 89 | 20-150 |
| 13C8-PFOS | | 119 | 20-150 | | 79 | 20-150 |
| 13C8-PFOSA | | 108 | 20-150 | | 73 | 20-150 |
| 13C9-PFNA | | 122 | 20-150 | | 75 | 20-150 |
| D3-NMeFOSA | | 73 | 20-150 | | 58 | 20-150 |
| D3-NMeFOSAA | | 90 | 20-150 | | 67 | 20-150 |
| D5-NEtFOSA | | 63 | 20-150 | | 53 | 20-150 |
| D5-NEtFOSAA | | 69 | 20-150 | | 59 | 20-150 |
| D7-NMeFOSE | M-03 | 21 | 20-150 | | 63 | 20-150 |
| D9-NEtFOSE | N | 9.0 | 20-150 | | 55 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-020
Description: VRTB-D-S2_01242024 | Matrix: Aqueous
Date Sampled: 01/24/2024 1345 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 0833 | BWS | 02/13/2024 1406 | 96346 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.85 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.65 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.5 | U | 4.9 | 4.5 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.96 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQ | 9.7 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQ | 9.7 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.56 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 16 | | 0.97 | 0.34 | 0.091 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 6.8 | M-03 | 3.9 | 1.6 | 0.50 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | U | 0.97 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 8.4 | | 0.97 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 6.9 | | 0.97 | 0.78 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 170 | | 0.97 | 0.71 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 12 | | 0.97 | 0.39 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.37 | U | 0.97 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.77 | JM-03 | 0.97 | 0.39 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 250 | B | 0.97 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 14 | | 0.97 | 0.78 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 40 | | 0.97 | 0.73 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 7.7 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.58 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | U | 0.97 | 0.39 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | U | 0.97 | 0.78 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-020
Description: VRTB-D-S2_01242024
Matrix: Aqueous
Date Sampled: 01/24/2024 1345
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 98 | 20-150 |
| 13C2-6:2FTS | | 85 | 20-150 |
| 13C2-8:2FTS | | 72 | 20-150 |
| 13C2-PFDoA | | 43 | 20-150 |
| 13C2-PFTeDA | M-03 | 20 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 |
| 13C3-PFBS | | 85 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 |
| 13C4-PFBA | | 79 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 |
| 13C6-PFDA | | 69 | 20-150 |
| 13C7-PFUnA | | 61 | 20-150 |
| 13C8-PFOA | | 76 | 20-150 |
| 13C8-PFOS | | 76 | 20-150 |
| 13C8-PFOSA | | 69 | 20-150 |
| 13C9-PFNA | | 72 | 20-150 |
| D3-NMeFOSA | | 50 | 20-150 |
| D3-NMeFOSAA | | 58 | 20-150 |
| D5-NEtFOSA | | 41 | 20-150 |
| D5-NEtFOSAA | | 46 | 20-150 |
| D7-NMeFOSE | N | 7.0 | 20-150 |
| D9-NEtFOSE | N | 4.0 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-021

Description: VRTB-D-B1_01242024 | Matrix: Aqueous

Date Sampled: 01/24/2024 1455 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 1312 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 10 | 02/21/2024 2035 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/28/2024 2030 | ARC2 | 02/27/2024 1815 | 97343 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | US | 3.8 | 2.2 | 0.83 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | US | 3.8 | 2.1 | 0.63 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | US | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 2.2 | JSM-03 | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | US | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 59 | S | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | USM-03 | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | US | 3.8 | 2.3 | 0.94 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQS | 9.5 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQS | 9.5 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | US | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | US | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | US | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | US | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 11 | | 0.95 | 0.33 | 0.089 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 25 | S | 3.8 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 42 | S | 0.95 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 100 | | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | US | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1000 | ES | 0.95 | 0.69 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 81 | | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | US | 0.95 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 15 | M-03 | 0.95 | 0.38 | 0.098 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2000 | BES | 0.95 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 120 | | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 38 | | 0.95 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 62 | S | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | US | 4.7 | 1.9 | 0.56 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.76 | UQ | 0.95 | 0.76 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-021
Description: VRTB-D-B1_01242024
Matrix: Aqueous
Date Sampled: 01/24/2024 1455
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 137 | 20-150 | | 111 | 20-150 | H | 93 | 20-150 |
| 13C2-6:2FTS | | 109 | 20-150 | | 126 | 20-150 | H | 87 | 20-150 |
| 13C2-8:2FTS | | 100 | 20-150 | | 55 | 20-150 | H | 85 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 | M-03 | 62 | 20-150 | H | 74 | 20-150 |
| 13C2-PFTeDA | M-03N | 13 | 20-150 | N | 16 | 20-150 | H | 50 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 92 | 20-150 | H | 97 | 20-150 |
| 13C3-PFBS | | 111 | 20-150 | | 139 | 20-150 | H | 99 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 | | 116 | 20-150 | H | 96 | 20-150 |
| 13C4-PFBA | | 86 | 20-150 | | 88 | 20-150 | H | 97 | 20-150 |
| 13C4-PFHpA | | 87 | 20-150 | | 86 | 20-150 | H | 96 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 92 | 20-150 | H | 99 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 | | 95 | 20-150 | H | 102 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | M-03 | 91 | 20-150 | H | 88 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 | M-03 | 75 | 20-150 | H | 88 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | M-03 | 100 | 20-150 | H | 92 | 20-150 |
| 13C8-PFOS | | 86 | 20-150 | | 69 | 20-150 | H | 94 | 20-150 |
| 13C8-PFOSA | | 111 | 20-150 | | 73 | 20-150 | H | 100 | 20-150 |
| 13C9-PFNA | | 84 | 20-150 | M-03 | 78 | 20-150 | H | 89 | 20-150 |
| D3-NMeFOSA | | 78 | 20-150 | | 56 | 20-150 | H | 71 | 20-150 |
| D3-NMeFOSAA | | 94 | 20-150 | | 79 | 20-150 | H | 78 | 20-150 |
| D5-NEtFOSA | | 66 | 20-150 | M-03 | 49 | 20-150 | H | 60 | 20-150 |
| D5-NEtFOSAA | | 67 | 20-150 | M-03 | 59 | 20-150 | H | 70 | 20-150 |
| D7-NMeFOSE | N | 8.0 | 20-150 | M-03N | 7.0 | 20-150 | H | 24 | 20-150 |
| D9-NEtFOSE | N | 4.0 | 20-150 | N | 3.0 | 20-150 | HN | 6.0 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-021
Description: VRTB-D-B1_01242024 | Matrix: Aqueous
Date Sampled: 01/24/2024 1455 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 1312 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 10 | 02/21/2024 2035 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/28/2024 2030 | ARC2 | 02/27/2024 1815 | 97343 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 22 | U | 38 | 22 | 8.3 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 21 | U | 38 | 21 | 6.3 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 22 | U | 38 | 22 | 6.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 14 | U | 38 | 14 | 5.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 14 | U | 38 | 14 | 3.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 46 | J | 47 | 43 | 19 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 96 | U | 240 | 96 | 41 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 23 | U | 38 | 23 | 9.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.8 | U | 9.5 | 3.8 | 1.2 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.6 | U | 9.5 | 7.6 | 2.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 19 | UQ | 95 | 19 | 5.8 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.6 | U | 9.5 | 7.6 | 2.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.6 | U | 9.5 | 7.6 | 2.8 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 19 | UQ | 95 | 19 | 6.0 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 12 | U | 19 | 12 | 5.5 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 10 | U | 19 | 10 | 3.4 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 6.1 | U | 19 | 6.1 | 1.8 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 12 | U | 19 | 12 | 3.7 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 10 | | 9.5 | 3.3 | 0.89 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 24 | JM-03 | 38 | 15 | 4.8 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.7 | U | 9.5 | 3.7 | 1.6 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.8 | U | 9.5 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.7 | U | 9.5 | 3.7 | 1.5 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.8 | U | 9.5 | 3.8 | 1.0 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 41 | M-03 | 9.5 | 3.6 | 1.8 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 100 | | 9.5 | 7.6 | 2.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 96 | U | 240 | 96 | 40 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 780 | | 9.5 | 6.9 | 1.7 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 71 | M-03 | 9.5 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.6 | U | 9.5 | 3.6 | 1.4 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 18 | M-03 | 9.5 | 3.8 | 0.98 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.8 | U | 9.5 | 3.8 | 1.9 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2400 | B | 9.5 | 7.0 | 2.3 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 120 | | 9.5 | 7.6 | 2.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 23 | M-03 | 9.5 | 7.1 | 2.4 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 58 | M-03 | 19 | 3.8 | 1.7 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 19 | U | 47 | 19 | 5.6 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.6 | UQ | 9.5 | 7.6 | 2.5 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.8 | U | 9.5 | 3.8 | 1.8 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.6 | U | 9.5 | 7.6 | 2.3 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-021

Description: VRTB-D-B1_01242024 | Matrix: Aqueous

Date Sampled: 01/24/2024 1455 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 137 | 20-150 | | 111 | 20-150 | H | 93 | 20-150 |
| 13C2-6:2FTS | | 109 | 20-150 | | 126 | 20-150 | H | 87 | 20-150 |
| 13C2-8:2FTS | | 100 | 20-150 | | 55 | 20-150 | H | 85 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 | M-03 | 62 | 20-150 | H | 74 | 20-150 |
| 13C2-PFTeDA | M-03N | 13 | 20-150 | N | 16 | 20-150 | H | 50 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 92 | 20-150 | H | 97 | 20-150 |
| 13C3-PFBS | | 111 | 20-150 | | 139 | 20-150 | H | 99 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 | | 116 | 20-150 | H | 96 | 20-150 |
| 13C4-PFBA | | 86 | 20-150 | | 88 | 20-150 | H | 97 | 20-150 |
| 13C4-PFHpA | | 87 | 20-150 | | 86 | 20-150 | H | 96 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 92 | 20-150 | H | 99 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 | | 95 | 20-150 | H | 102 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | M-03 | 91 | 20-150 | H | 88 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 | M-03 | 75 | 20-150 | H | 88 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | M-03 | 100 | 20-150 | H | 92 | 20-150 |
| 13C8-PFOS | | 86 | 20-150 | | 69 | 20-150 | H | 94 | 20-150 |
| 13C8-PFOSA | | 111 | 20-150 | | 73 | 20-150 | H | 100 | 20-150 |
| 13C9-PFNA | | 84 | 20-150 | M-03 | 78 | 20-150 | H | 89 | 20-150 |
| D3-NMeFOSA | | 78 | 20-150 | | 56 | 20-150 | H | 71 | 20-150 |
| D3-NMeFOSAA | | 94 | 20-150 | | 79 | 20-150 | H | 78 | 20-150 |
| D5-NEtFOSA | | 66 | 20-150 | M-03 | 49 | 20-150 | H | 60 | 20-150 |
| D5-NEtFOSAA | | 67 | 20-150 | M-03 | 59 | 20-150 | H | 70 | 20-150 |
| D7-NMeFOSE | N | 8.0 | 20-150 | M-03N | 7.0 | 20-150 | H | 24 | 20-150 |
| D9-NEtFOSE | N | 4.0 | 20-150 | N | 3.0 | 20-150 | HN | 6.0 | 20-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-021

Description: VRTB-D-B1_01242024 | Matrix: Aqueous

Date Sampled: 01/24/2024 1455 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 1312 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 10 | 02/21/2024 2035 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/28/2024 2030 | ARC2 | 02/27/2024 1815 | 97343 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | UH | 20 | 12 | 4.4 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | UH | 20 | 11 | 3.3 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | UH | 20 | 12 | 3.3 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | UH | 20 | 7.5 | 3.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | UH | 20 | 7.5 | 2.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 50 | HM-03 | 25 | 23 | 10 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | UH | 130 | 52 | 21 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | UH | 20 | 12 | 5.0 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.64 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.5 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | UHQ | 50 | 10 | 3.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.5 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | UH | 50 | 10 | 3.2 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | UH | 10 | 6.5 | 2.9 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | UH | 10 | 5.5 | 1.8 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | UH | 10 | 3.2 | 0.92 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | UH | 10 | 6.5 | 1.9 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 11 | HM-03 | 5.0 | 1.8 | 0.47 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 23 | H | 20 | 8.0 | 2.6 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.82 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.68 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.77 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.53 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 32 | H | 5.0 | 1.9 | 0.95 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 100 | H | 5.0 | 4.0 | 1.1 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | UH | 130 | 52 | 21 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 990 | HM-03 | 5.0 | 3.7 | 0.92 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 84 | H | 5.0 | 2.0 | 0.71 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | UH | 5.0 | 1.9 | 0.73 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 14 | HM-03 | 5.0 | 2.0 | 0.52 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.99 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1900 | BH | 5.0 | 3.7 | 1.2 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 130 | HM-03 | 5.0 | 4.0 | 1.0 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 23 | H | 5.0 | 3.8 | 1.3 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 61 | H | 10 | 2.0 | 0.92 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | UH | 25 | 10 | 3.0 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.3 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.97 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.2 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-021
Description: VRTB-D-B1_01242024
Matrix: Aqueous
Date Sampled: 01/24/2024 1455
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 137 | 20-150 | | 111 | 20-150 | H | 93 | 20-150 |
| 13C2-6:2FTS | | 109 | 20-150 | | 126 | 20-150 | H | 87 | 20-150 |
| 13C2-8:2FTS | | 100 | 20-150 | | 55 | 20-150 | H | 85 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 | M-03 | 62 | 20-150 | H | 74 | 20-150 |
| 13C2-PFTeDA | M-03N | 13 | 20-150 | N | 16 | 20-150 | H | 50 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 92 | 20-150 | H | 97 | 20-150 |
| 13C3-PFBS | | 111 | 20-150 | | 139 | 20-150 | H | 99 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 | | 116 | 20-150 | H | 96 | 20-150 |
| 13C4-PFBA | | 86 | 20-150 | | 88 | 20-150 | H | 97 | 20-150 |
| 13C4-PFHpA | | 87 | 20-150 | | 86 | 20-150 | H | 96 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 92 | 20-150 | H | 99 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 | | 95 | 20-150 | H | 102 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | M-03 | 91 | 20-150 | H | 88 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 | M-03 | 75 | 20-150 | H | 88 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | M-03 | 100 | 20-150 | H | 92 | 20-150 |
| 13C8-PFOS | | 86 | 20-150 | | 69 | 20-150 | H | 94 | 20-150 |
| 13C8-PFOSA | | 111 | 20-150 | | 73 | 20-150 | H | 100 | 20-150 |
| 13C9-PFNA | | 84 | 20-150 | M-03 | 78 | 20-150 | H | 89 | 20-150 |
| D3-NMeFOSA | | 78 | 20-150 | | 56 | 20-150 | H | 71 | 20-150 |
| D3-NMeFOSAA | | 94 | 20-150 | | 79 | 20-150 | H | 78 | 20-150 |
| D5-NEtFOSA | | 66 | 20-150 | M-03 | 49 | 20-150 | H | 60 | 20-150 |
| D5-NEtFOSAA | | 67 | 20-150 | M-03 | 59 | 20-150 | H | 70 | 20-150 |
| D7-NMeFOSE | N | 8.0 | 20-150 | M-03N | 7.0 | 20-150 | H | 24 | 20-150 |
| D9-NEtFOSE | N | 4.0 | 20-150 | N | 3.0 | 20-150 | HN | 6.0 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-022

Description: VRTB-S-P8_01242024 | Matrix: Aqueous

Date Sampled: 01/24/2024 1535 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 1350 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 5 | 02/21/2024 2052 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/28/2024 2039 | ARC2 | 02/27/2024 1815 | 97343 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.85 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.65 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.65 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 16 | | 4.9 | 4.5 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.97 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | UQ | 9.8 | 2.0 | 0.60 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | UQ | 9.8 | 2.0 | 0.62 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.56 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 55 | | 0.98 | 0.34 | 0.092 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 18 | M-03 | 3.9 | 1.6 | 0.50 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | U | 0.98 | 0.38 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | U | 0.98 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 130 | | 0.98 | 0.37 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 21 | | 0.98 | 0.78 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 960 | EM-03 | 0.98 | 0.72 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 58 | | 0.98 | 0.39 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.37 | U | 0.98 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 19 | M-03 | 0.98 | 0.39 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.26 | JQM-03 | 0.98 | 0.39 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 6900 | BEM-03 | 0.98 | 0.73 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 60 | | 0.98 | 0.78 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 38 | | 0.98 | 0.74 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 30 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.58 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-022

Description: VRTB-S-P8_01242024 | Matrix: Aqueous

Date Sampled: 01/24/2024 1535 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 118 | 20-150 | | 122 | 20-150 | H | 74 | 20-150 |
| 13C2-6:2FTS | | 106 | 20-150 | | 124 | 20-150 | H | 86 | 20-150 |
| 13C2-8:2FTS | | 96 | 20-150 | | 90 | 20-150 | H | 81 | 20-150 |
| 13C2-PFDoA | | 49 | 20-150 | | 42 | 20-150 | H | 72 | 20-150 |
| 13C2-PFTeDA | M-03 | 21 | 20-150 | M-03N | 19 | 20-150 | H | 73 | 20-150 |
| 13C3-HFPO-DA | | 93 | 20-150 | | 98 | 20-150 | H | 82 | 20-150 |
| 13C3-PFBS | | 114 | 20-150 | | 107 | 20-150 | H | 81 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 | | 106 | 20-150 | H | 82 | 20-150 |
| 13C4-PFBA | M-03 | 91 | 20-150 | M-03 | 98 | 20-150 | H | 86 | 20-150 |
| 13C4-PFHpA | | 96 | 20-150 | | 92 | 20-150 | H | 83 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 | | 90 | 20-150 | H | 81 | 20-150 |
| 13C5-PFPeA | | 97 | 20-150 | | 115 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | | 76 | 20-150 | H | 80 | 20-150 |
| 13C7-PFUnA | M-03 | 65 | 20-150 | M-03 | 64 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | | 92 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 | M-03 | 86 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOSA | N | 158 | 20-150 | M-03 | 82 | 20-150 | H | 89 | 20-150 |
| 13C9-PFNA | | 84 | 20-150 | | 72 | 20-150 | H | 84 | 20-150 |
| D3-NMeFOSA | | 114 | 20-150 | | 54 | 20-150 | H | 62 | 20-150 |
| D3-NMeFOSAA | | 99 | 20-150 | | 54 | 20-150 | H | 79 | 20-150 |
| D5-NEtFOSA | | 91 | 20-150 | | 49 | 20-150 | H | 62 | 20-150 |
| D5-NEtFOSAA | | 66 | 20-150 | | 49 | 20-150 | H | 77 | 20-150 |
| D7-NMeFOSE | N | 11 | 20-150 | N | 5.0 | 20-150 | H | 71 | 20-150 |
| D9-NEtFOSE | N | 6.0 | 20-150 | N | 3.0 | 20-150 | H | 70 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-022

Description: VRTB-S-P8_01242024 | Matrix: Aqueous

Date Sampled: 01/24/2024 1535 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 1350 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 5 | 02/21/2024 2052 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/28/2024 2039 | ARC2 | 02/27/2024 1815 | 97343 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | U | 20 | 12 | 4.3 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | U | 20 | 11 | 3.3 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | U | 20 | 12 | 3.2 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | U | 20 | 7.5 | 3.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | U | 20 | 7.5 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 9.9 | J | 24 | 22 | 9.9 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | U | 20 | 12 | 4.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.63 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.8 | UQ | 49 | 9.8 | 3.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.8 | UQ | 49 | 9.8 | 3.1 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.4 | U | 9.8 | 6.4 | 2.8 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.4 | U | 9.8 | 5.4 | 1.8 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.1 | U | 9.8 | 3.1 | 0.90 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.4 | U | 9.8 | 6.4 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 56 | | 4.9 | 1.7 | 0.46 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 19 | JM-03 | 20 | 8.0 | 2.5 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.80 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.66 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.75 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.52 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 72 | M-03 | 4.9 | 1.9 | 0.93 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 20 | | 4.9 | 3.9 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 790 | M-03 | 4.9 | 3.6 | 0.90 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 54 | | 4.9 | 2.0 | 0.69 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | U | 4.9 | 1.9 | 0.71 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 21 | M-03 | 4.9 | 2.0 | 0.50 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.97 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 3.6 | U | 4.9 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 50 | | 4.9 | 3.9 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 35 | | 4.9 | 3.7 | 1.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 26 | | 9.8 | 2.0 | 0.90 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.9 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.9 | UQ | 4.9 | 3.9 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.95 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.9 | U | 4.9 | 3.9 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-022

Description: VRTB-S-P8_01242024 | Matrix: Aqueous

Date Sampled: 01/24/2024 1535 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 118 | 20-150 | | 122 | 20-150 | H | 74 | 20-150 |
| 13C2-6:2FTS | | 106 | 20-150 | | 124 | 20-150 | H | 86 | 20-150 |
| 13C2-8:2FTS | | 96 | 20-150 | | 90 | 20-150 | H | 81 | 20-150 |
| 13C2-PFDoA | | 49 | 20-150 | | 42 | 20-150 | H | 72 | 20-150 |
| 13C2-PFTeDA | M-03 | 21 | 20-150 | M-03N | 19 | 20-150 | H | 73 | 20-150 |
| 13C3-HFPO-DA | | 93 | 20-150 | | 98 | 20-150 | H | 82 | 20-150 |
| 13C3-PFBS | | 114 | 20-150 | | 107 | 20-150 | H | 81 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 | | 106 | 20-150 | H | 82 | 20-150 |
| 13C4-PFBA | M-03 | 91 | 20-150 | M-03 | 98 | 20-150 | H | 86 | 20-150 |
| 13C4-PFHpA | | 96 | 20-150 | | 92 | 20-150 | H | 83 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 | | 90 | 20-150 | H | 81 | 20-150 |
| 13C5-PFPeA | | 97 | 20-150 | | 115 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | | 76 | 20-150 | H | 80 | 20-150 |
| 13C7-PFUnA | M-03 | 65 | 20-150 | M-03 | 64 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | | 92 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 | M-03 | 86 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOSA | N | 158 | 20-150 | M-03 | 82 | 20-150 | H | 89 | 20-150 |
| 13C9-PFNA | | 84 | 20-150 | | 72 | 20-150 | H | 84 | 20-150 |
| D3-NMeFOSA | | 114 | 20-150 | | 54 | 20-150 | H | 62 | 20-150 |
| D3-NMeFOSAA | | 99 | 20-150 | | 54 | 20-150 | H | 79 | 20-150 |
| D5-NEtFOSA | | 91 | 20-150 | | 49 | 20-150 | H | 62 | 20-150 |
| D5-NEtFOSAA | | 66 | 20-150 | | 49 | 20-150 | H | 77 | 20-150 |
| D7-NMeFOSE | N | 11 | 20-150 | N | 5.0 | 20-150 | H | 71 | 20-150 |
| D9-NEtFOSE | N | 6.0 | 20-150 | N | 3.0 | 20-150 | H | 70 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-022

Description: VRTB-S-P8_01242024 | Matrix: Aqueous

Date Sampled: 01/24/2024 1535 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/20/2024 1350 | BWS | 02/13/2024 1406 | 96346 |
| 2 | 1633 | 1633 | 5 | 02/21/2024 2052 | BWS | 02/13/2024 1406 | 96346 |
| 3 | 1633 | 1633 | 1 | 02/28/2024 2039 | ARC2 | 02/27/2024 1815 | 97343 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 46 | UH | 80 | 46 | 17 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 44 | UH | 80 | 44 | 13 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 46 | UH | 80 | 46 | 13 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 30 | UH | 80 | 30 | 12 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 30 | UH | 80 | 30 | 8.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 92 | UH | 100 | 92 | 40 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 200 | UH | 500 | 200 | 86 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 48 | UH | 80 | 48 | 20 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.6 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 16 | UH | 20 | 16 | 5.8 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 40 | UH | 200 | 40 | 12 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 16 | UH | 20 | 16 | 4.3 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 16 | UH | 20 | 16 | 5.9 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 40 | UH | 200 | 40 | 13 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 26 | UH | 40 | 26 | 12 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 22 | UH | 40 | 22 | 7.2 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 13 | UH | 40 | 13 | 3.7 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 26 | UH | 40 | 26 | 7.8 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 62 | HM-03 | 20 | 7.0 | 1.9 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 18 | HJM-03 | 80 | 32 | 10 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 7.8 | UH | 20 | 7.8 | 3.3 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.7 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 7.8 | UH | 20 | 7.8 | 3.1 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 8.0 | UH | 20 | 8.0 | 2.1 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 85 | HM-03 | 20 | 7.6 | 3.8 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 27 | HM-03 | 20 | 16 | 4.3 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 200 | UH | 500 | 200 | 84 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1100 | HM-03 | 20 | 15 | 3.7 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 64 | H | 20 | 8.0 | 2.8 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 7.6 | UH | 20 | 7.6 | 2.9 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 14 | HJM-03 | 20 | 8.0 | 2.1 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 8.0 | UH | 20 | 8.0 | 4.0 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 9600 | BHSM-03 | 20 | 15 | 4.9 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 74 | HM-03 | 20 | 16 | 4.2 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 32 | H | 20 | 15 | 5.1 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 8.0 | UH | 40 | 8.0 | 3.7 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 40 | UH | 100 | 40 | 12 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 16 | UH | 20 | 16 | 5.4 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 8.0 | UH | 20 | 8.0 | 3.9 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 16 | UH | 20 | 16 | 5.0 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-022
Description: VRTB-S-P8_01242024
Matrix: Aqueous
Date Sampled: 01/24/2024 1535
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 118 | 20-150 | | 122 | 20-150 | H | 74 | 20-150 |
| 13C2-6:2FTS | | 106 | 20-150 | | 124 | 20-150 | H | 86 | 20-150 |
| 13C2-8:2FTS | | 96 | 20-150 | | 90 | 20-150 | H | 81 | 20-150 |
| 13C2-PFDoA | | 49 | 20-150 | | 42 | 20-150 | H | 72 | 20-150 |
| 13C2-PFTeDA | M-03 | 21 | 20-150 | M-03N | 19 | 20-150 | H | 73 | 20-150 |
| 13C3-HFPO-DA | | 93 | 20-150 | | 98 | 20-150 | H | 82 | 20-150 |
| 13C3-PFBS | | 114 | 20-150 | | 107 | 20-150 | H | 81 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 | | 106 | 20-150 | H | 82 | 20-150 |
| 13C4-PFBA | M-03 | 91 | 20-150 | M-03 | 98 | 20-150 | H | 86 | 20-150 |
| 13C4-PFHpA | | 96 | 20-150 | | 92 | 20-150 | H | 83 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 | | 90 | 20-150 | H | 81 | 20-150 |
| 13C5-PFPeA | | 97 | 20-150 | | 115 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | | 76 | 20-150 | H | 80 | 20-150 |
| 13C7-PFUnA | M-03 | 65 | 20-150 | M-03 | 64 | 20-150 | H | 73 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | | 92 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 | M-03 | 86 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOSA | N | 158 | 20-150 | M-03 | 82 | 20-150 | H | 89 | 20-150 |
| 13C9-PFNA | | 84 | 20-150 | | 72 | 20-150 | H | 84 | 20-150 |
| D3-NMeFOSA | | 114 | 20-150 | | 54 | 20-150 | H | 62 | 20-150 |
| D3-NMeFOSAA | | 99 | 20-150 | | 54 | 20-150 | H | 79 | 20-150 |
| D5-NEtFOSA | | 91 | 20-150 | | 49 | 20-150 | H | 62 | 20-150 |
| D5-NEtFOSAA | | 66 | 20-150 | | 49 | 20-150 | H | 77 | 20-150 |
| D7-NMeFOSE | N | 11 | 20-150 | N | 5.0 | 20-150 | H | 71 | 20-150 |
| D9-NEtFOSE | N | 6.0 | 20-150 | N | 3.0 | 20-150 | H | 70 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-023
Description: VRTB-S-R7_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 0845 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1357 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 0948 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 1916 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 63 | | 3.8 | 1.4 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 110 | | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQ | 9.6 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQ | 9.6 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 19 | | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 57 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 280 | | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 160 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2600 | EM-03 | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 230 | | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.87 | JM-03 | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 98 | M-03 | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 4.7 | M-03 | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 28000 | BEM-03 | 0.96 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 280 | M-03 | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 69 | | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 130 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | UQ | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-023
Description: VRTB-S-R7_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 0845 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 102 | 20-150 | | 82 | 20-150 | H | 71 | 20-150 |
| 13C2-6:2FTS | | 98 | 20-150 | | 90 | 20-150 | H | 75 | 20-150 |
| 13C2-8:2FTS | | 79 | 20-150 | | 67 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | | 63 | 20-150 | | 71 | 20-150 | H | 71 | 20-150 |
| 13C2-PFTeDA | M-03N | 12 | 20-150 | N | 12 | 20-150 | H | 65 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | | 87 | 20-150 | H | 74 | 20-150 |
| 13C3-PFBS | | 108 | 20-150 | | 99 | 20-150 | H | 72 | 20-150 |
| 13C3-PFHxS | | 90 | 20-150 | | 81 | 20-150 | H | 74 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 | | 93 | 20-150 | H | 74 | 20-150 |
| 13C4-PFHpA | | 99 | 20-150 | | 84 | 20-150 | H | 73 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 | | 87 | 20-150 | H | 71 | 20-150 |
| 13C5-PFPeA | | 91 | 20-150 | | 86 | 20-150 | H | 77 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | | 89 | 20-150 | H | 73 | 20-150 |
| 13C7-PFUnA | | 65 | 20-150 | | 68 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 | | 96 | 20-150 | H | 63 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 | | 73 | 20-150 | H | 70 | 20-150 |
| 13C8-PFOSA | | 135 | 20-150 | | 92 | 20-150 | H | 67 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | | 84 | 20-150 | H | 72 | 20-150 |
| D3-NMeFOSA | | 106 | 20-150 | | 74 | 20-150 | H | 30 | 20-150 |
| D3-NMeFOSAA | | 131 | 20-150 | | 96 | 20-150 | H | 75 | 20-150 |
| D5-NEtFOSA | | 91 | 20-150 | | 66 | 20-150 | H | 35 | 20-150 |
| D5-NEtFOSAA | M-03 | 91 | 20-150 | | 74 | 20-150 | H | 68 | 20-150 |
| D7-NMeFOSE | N | 2.0 | 20-150 | N | 2.0 | 20-150 | H | 63 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | M-03N | 1.0 | 20-150 | H | 63 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-023

Description: VRTB-S-R7_01252024 | Matrix: Aqueous

Date Sampled: 01/25/2024 0845 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1357 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 0948 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 1916 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.2 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.2 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.2 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 65 | M-03 | 19 | 7.1 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 100 | M-03 | 24 | 22 | 9.7 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.62 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.6 | UQ | 48 | 9.6 | 2.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.6 | UQ | 48 | 9.6 | 3.0 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.2 | U | 9.6 | 6.2 | 2.8 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.3 | U | 9.6 | 5.3 | 1.7 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.1 | U | 9.6 | 3.1 | 0.89 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.2 | U | 9.6 | 6.2 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 18 | | 4.8 | 1.7 | 0.45 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 56 | | 19 | 7.6 | 2.4 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.79 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.65 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.74 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.51 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 210 | | 4.8 | 1.8 | 0.91 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 170 | | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2700 | M-03 | 4.8 | 3.5 | 0.89 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 230 | | 4.8 | 1.9 | 0.68 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.8 | U | 4.8 | 1.8 | 0.70 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 91 | | 4.8 | 1.9 | 0.49 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 4.6 | JM-03 | 4.8 | 1.9 | 0.95 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 30000 | BEM-03 | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 300 | M-03 | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 59 | | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 130 | | 9.6 | 1.9 | 0.89 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.9 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.8 | UQ | 4.8 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.93 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-023

Description: VRTB-S-R7_01252024 | Matrix: Aqueous

Date Sampled: 01/25/2024 0845 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 102 | 20-150 | | 82 | 20-150 | H | 71 | 20-150 |
| 13C2-6:2FTS | | 98 | 20-150 | | 90 | 20-150 | H | 75 | 20-150 |
| 13C2-8:2FTS | | 79 | 20-150 | | 67 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | | 63 | 20-150 | | 71 | 20-150 | H | 71 | 20-150 |
| 13C2-PFTeDA | M-03N | 12 | 20-150 | N | 12 | 20-150 | H | 65 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | | 87 | 20-150 | H | 74 | 20-150 |
| 13C3-PFBS | | 108 | 20-150 | | 99 | 20-150 | H | 72 | 20-150 |
| 13C3-PFHxS | | 90 | 20-150 | | 81 | 20-150 | H | 74 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 | | 93 | 20-150 | H | 74 | 20-150 |
| 13C4-PFHpA | | 99 | 20-150 | | 84 | 20-150 | H | 73 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 | | 87 | 20-150 | H | 71 | 20-150 |
| 13C5-PFPeA | | 91 | 20-150 | | 86 | 20-150 | H | 77 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | | 89 | 20-150 | H | 73 | 20-150 |
| 13C7-PFUnA | | 65 | 20-150 | | 68 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 | | 96 | 20-150 | H | 63 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 | | 73 | 20-150 | H | 70 | 20-150 |
| 13C8-PFOSA | | 135 | 20-150 | | 92 | 20-150 | H | 67 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | | 84 | 20-150 | H | 72 | 20-150 |
| D3-NMeFOSA | | 106 | 20-150 | | 74 | 20-150 | H | 30 | 20-150 |
| D3-NMeFOSAA | | 131 | 20-150 | | 96 | 20-150 | H | 75 | 20-150 |
| D5-NEtFOSA | | 91 | 20-150 | | 66 | 20-150 | H | 35 | 20-150 |
| D5-NEtFOSAA | M-03 | 91 | 20-150 | | 74 | 20-150 | H | 68 | 20-150 |
| D7-NMeFOSE | N | 2.0 | 20-150 | N | 2.0 | 20-150 | H | 63 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | M-03N | 1.0 | 20-150 | H | 63 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-023
Description: VRTB-S-R7_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 0845 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1357 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 0948 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 1916 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | UH | 400 | 230 | 87 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | UH | 400 | 220 | 67 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | UH | 400 | 230 | 66 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 150 | UHL | 400 | 150 | 61 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | UH | 400 | 150 | 40 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 460 | UH | 500 | 460 | 200 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | UH | 2500 | 1000 | 430 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | UH | 400 | 240 | 99 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | UH | 100 | 40 | 13 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | UH | 1000 | 200 | 61 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | UH | 100 | 80 | 22 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | UH | 1000 | 200 | 63 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | UH | 200 | 130 | 58 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | UH | 200 | 110 | 36 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | UH | 200 | 64 | 18 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | UH | 200 | 130 | 39 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 18 | HJM-03 | 100 | 35 | 9.4 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 130 | HJ | 400 | 160 | 51 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | UH | 100 | 39 | 16 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | UH | 100 | 40 | 14 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | UH | 100 | 39 | 15 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | UH | 100 | 40 | 11 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 170 | HM-03 | 100 | 38 | 19 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 210 | H | 100 | 80 | 21 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | UH | 2500 | 1000 | 420 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2600 | H | 100 | 73 | 18 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 240 | H | 100 | 40 | 14 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | UH | 100 | 38 | 15 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 85 | HJM-03 | 100 | 40 | 10 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 40 | UH | 100 | 40 | 20 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 27000 | HM-03 | 100 | 74 | 25 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 370 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 55 | HJM-03 | 100 | 75 | 26 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 40 | UH | 200 | 40 | 18 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | UH | 500 | 200 | 60 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | UH | 100 | 80 | 27 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | UH | 100 | 40 | 19 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | UH | 100 | 80 | 25 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-023
Description: VRTB-S-R7_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024 0845
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 102 | 20-150 | | 82 | 20-150 | H | 71 | 20-150 |
| 13C2-6:2FTS | | 98 | 20-150 | | 90 | 20-150 | H | 75 | 20-150 |
| 13C2-8:2FTS | | 79 | 20-150 | | 67 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | | 63 | 20-150 | | 71 | 20-150 | H | 71 | 20-150 |
| 13C2-PFTeDA | M-03N | 12 | 20-150 | N | 12 | 20-150 | H | 65 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | | 87 | 20-150 | H | 74 | 20-150 |
| 13C3-PFBS | | 108 | 20-150 | | 99 | 20-150 | H | 72 | 20-150 |
| 13C3-PFHxS | | 90 | 20-150 | | 81 | 20-150 | H | 74 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 | | 93 | 20-150 | H | 74 | 20-150 |
| 13C4-PFHpA | | 99 | 20-150 | | 84 | 20-150 | H | 73 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 | | 87 | 20-150 | H | 71 | 20-150 |
| 13C5-PFPeA | | 91 | 20-150 | | 86 | 20-150 | H | 77 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 | | 89 | 20-150 | H | 73 | 20-150 |
| 13C7-PFUnA | | 65 | 20-150 | | 68 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 | | 96 | 20-150 | H | 63 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 | | 73 | 20-150 | H | 70 | 20-150 |
| 13C8-PFOSA | | 135 | 20-150 | | 92 | 20-150 | H | 67 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | | 84 | 20-150 | H | 72 | 20-150 |
| D3-NMeFOSA | | 106 | 20-150 | | 74 | 20-150 | H | 30 | 20-150 |
| D3-NMeFOSAA | | 131 | 20-150 | | 96 | 20-150 | H | 75 | 20-150 |
| D5-NEtFOSA | | 91 | 20-150 | | 66 | 20-150 | H | 35 | 20-150 |
| D5-NEtFOSAA | M-03 | 91 | 20-150 | | 74 | 20-150 | H | 68 | 20-150 |
| D7-NMeFOSE | N | 2.0 | 20-150 | N | 2.0 | 20-150 | H | 63 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | M-03N | 1.0 | 20-150 | H | 63 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-024
Description: VRTB-S-O6_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 0950 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1406 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 1016 | ALM | 02/14/2024 1520 | 96443 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.83 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 0.87 | JM-03 | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 3.2 | JM-03 | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQ | 9.5 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQ | 9.5 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 15 | | 0.95 | 0.33 | 0.089 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 16 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.74 | JM-03 | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 88 | | 0.95 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 16 | | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 520 | M-03 | 0.95 | 0.69 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 36 | | 0.95 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.69 | JM-03 | 0.95 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 8.1 | | 0.95 | 0.38 | 0.098 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 5.6 | M-03 | 0.95 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2000 | BM-03 | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 63 | M-03 | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 33 | | 0.95 | 0.71 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 20 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-024
Description: VRTB-S-O6_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024 0950
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 82 | 20-150 | | 89 | 20-150 |
| 13C2-6:2FTS | | 85 | 20-150 | | 75 | 20-150 |
| 13C2-8:2FTS | | 81 | 20-150 | | 66 | 20-150 |
| 13C2-PFDoA | | 56 | 20-150 | | 56 | 20-150 |
| 13C2-PFTeDA | | 23 | 20-150 | | 37 | 20-150 |
| 13C3-HFPO-DA | | 94 | 20-150 | | 95 | 20-150 |
| 13C3-PFBS | | 93 | 20-150 | | 86 | 20-150 |
| 13C3-PFHxS | | 87 | 20-150 | | 77 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | | 89 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | | 92 | 20-150 |
| 13C5-PFHxA | | 87 | 20-150 | | 93 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 90 | 20-150 |
| 13C6-PFDA | | 75 | 20-150 | | 72 | 20-150 |
| 13C7-PFUnA | M-03 | 71 | 20-150 | | 68 | 20-150 |
| 13C8-PFOA | | 93 | 20-150 | | 91 | 20-150 |
| 13C8-PFOS | | 76 | 20-150 | | 84 | 20-150 |
| 13C8-PFOSA | | 85 | 20-150 | | 78 | 20-150 |
| 13C9-PFNA | | 86 | 20-150 | | 79 | 20-150 |
| D3-NMeFOSA | | 65 | 20-150 | | 57 | 20-150 |
| D3-NMeFOSAA | | 83 | 20-150 | | 71 | 20-150 |
| D5-NEtFOSA | | 58 | 20-150 | | 52 | 20-150 |
| D5-NEtFOSAA | | 72 | 20-150 | | 69 | 20-150 |
| D7-NMeFOSE | N | 9.0 | 20-150 | N | 8.0 | 20-150 |
| D9-NEtFOSE | N | 2.0 | 20-150 | N | 2.0 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-025
Description: VRTB-S-M5_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 1035 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1416 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 10 | 02/23/2024 1025 | ALM | 02/14/2024 1520 | 96443 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.83 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.63 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 34 | M-03 | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 58 | | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.94 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQ | 9.5 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQ | 9.5 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 7.3 | | 0.95 | 0.33 | 0.089 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 31 | M-03 | 3.8 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | J | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 65 | M-03 | 0.95 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 74 | | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 860 | | 9.5 | 6.9 | 1.7 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 100 | | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.24 | JM-03 | 0.95 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 23 | M-03 | 0.95 | 0.38 | 0.098 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.63 | JM-03 | 0.95 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 4400 | BM-03 | 9.5 | 7.0 | 2.3 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 130 | M-03 | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 26 | | 0.95 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 68 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.56 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.76 | UQ | 0.95 | 0.76 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-025
Description: VRTB-S-M5_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024 1035
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 89 | 20-150 | | 74 | 20-150 |
| 13C2-6:2FTS | | 95 | 20-150 | | 105 | 20-150 |
| 13C2-8:2FTS | | 65 | 20-150 | M-03 | 69 | 20-150 |
| 13C2-PFDoA | | 55 | 20-150 | | 57 | 20-150 |
| 13C2-PFTeDA | N | 14 | 20-150 | M-03 | 21 | 20-150 |
| 13C3-HFPO-DA | | 94 | 20-150 | | 84 | 20-150 |
| 13C3-PFBS | | 94 | 20-150 | | 91 | 20-150 |
| 13C3-PFHxS | | 81 | 20-150 | M-03 | 88 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 | | 88 | 20-150 |
| 13C4-PFHpA | | 91 | 20-150 | | 79 | 20-150 |
| 13C5-PFHxA | | 85 | 20-150 | | 88 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 77 | 20-150 |
| 13C6-PFDA | | 77 | 20-150 | | 67 | 20-150 |
| 13C7-PFUnA | | 67 | 20-150 | | 62 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | | 85 | 20-150 |
| 13C8-PFOS | | 74 | 20-150 | | 84 | 20-150 |
| 13C8-PFOSA | | 96 | 20-150 | M-03 | 78 | 20-150 |
| 13C9-PFNA | | 81 | 20-150 | | 63 | 20-150 |
| D3-NMeFOSA | | 68 | 20-150 | | 59 | 20-150 |
| D3-NMeFOSAA | | 96 | 20-150 | | 75 | 20-150 |
| D5-NEtFOSA | M-03 | 59 | 20-150 | | 46 | 20-150 |
| D5-NEtFOSAA | | 79 | 20-150 | | 73 | 20-150 |
| D7-NMeFOSE | N | 3.0 | 20-150 | N | 2.0 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-026
Description: VRTB-L-G4_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 1125 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1425 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 10 | 02/23/2024 1034 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 1943 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.80 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.62 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 73 | | 3.7 | 1.4 | 0.56 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 41 | | 4.6 | 4.2 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.91 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UQ | 9.2 | 1.8 | 0.56 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.2 | 1.8 | 0.58 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.53 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.4 | | 0.92 | 0.32 | 0.086 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 17 | | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.92 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.29 | JM-03 | 0.92 | 0.37 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.92 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.098 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 45 | | 0.92 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 40 | | 0.92 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.8 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 450 | M-03 | 0.92 | 0.67 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 41 | | 0.92 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.29 | JM-03 | 0.92 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 28 | | 0.92 | 0.37 | 0.095 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.9 | M-03 | 0.92 | 0.37 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 4900 | BEM-03 | 0.92 | 0.68 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 67 | M-03 | 0.92 | 0.74 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 14 | | 0.92 | 0.69 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 36 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-026
Description: VRTB-L-G4_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024 1125
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 90 | 20-150 | | 106 | 20-150 | H | 86 | 20-150 |
| 13C2-6:2FTS | | 87 | 20-150 | | 96 | 20-150 | H | 82 | 20-150 |
| 13C2-8:2FTS | | 73 | 20-150 | | 75 | 20-150 | H | 77 | 20-150 |
| 13C2-PFDoA | | 63 | 20-150 | M-03 | 63 | 20-150 | H | 70 | 20-150 |
| 13C2-PFTeDA | | 39 | 20-150 | | 42 | 20-150 | H | 39 | 20-150 |
| 13C3-HFPO-DA | | 95 | 20-150 | | 88 | 20-150 | H | 92 | 20-150 |
| 13C3-PFBS | | 98 | 20-150 | | 102 | 20-150 | H | 86 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | | 97 | 20-150 | H | 81 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 | | 88 | 20-150 | H | 88 | 20-150 |
| 13C4-PFHpA | | 90 | 20-150 | | 83 | 20-150 | H | 92 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 90 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 87 | 20-150 | H | 97 | 20-150 |
| 13C6-PFDA | | 82 | 20-150 | | 89 | 20-150 | H | 86 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 | M-03 | 64 | 20-150 | H | 80 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 | | 90 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOS | | 79 | 20-150 | | 94 | 20-150 | H | 79 | 20-150 |
| 13C8-PFOSA | | 104 | 20-150 | | 86 | 20-150 | H | 103 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 | | 86 | 20-150 | H | 89 | 20-150 |
| D3-NMeFOSA | | 81 | 20-150 | M-03 | 70 | 20-150 | H | 62 | 20-150 |
| D3-NMeFOSAA | | 109 | 20-150 | | 85 | 20-150 | H | 106 | 20-150 |
| D5-NEtFOSA | | 77 | 20-150 | M-03 | 61 | 20-150 | H | 62 | 20-150 |
| D5-NEtFOSAA | M-03 | 93 | 20-150 | M-03 | 79 | 20-150 | H | 92 | 20-150 |
| D7-NMeFOSE | | 26 | 20-150 | N | 19 | 20-150 | HN | 5.0 | 20-150 |
| D9-NEtFOSE | N | 5.0 | 20-150 | N | 4.0 | 20-150 | HN | 1.0 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-026
Description: VRTB-L-G4_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 1125 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1425 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 10 | 02/23/2024 1034 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 1943 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 21 | U | 37 | 21 | 8.0 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 20 | U | 37 | 20 | 6.2 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 21 | U | 37 | 21 | 6.1 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 66 | | 37 | 14 | 5.6 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 14 | U | 37 | 14 | 3.7 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 33 | JM-03 | 46 | 42 | 19 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 92 | U | 230 | 92 | 39 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 22 | U | 37 | 22 | 9.1 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.7 | U | 9.2 | 3.7 | 1.2 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.4 | U | 9.2 | 7.4 | 2.7 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 18 | UQ | 92 | 18 | 5.6 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.4 | U | 9.2 | 7.4 | 2.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.4 | U | 9.2 | 7.4 | 2.7 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 18 | UQ | 92 | 18 | 5.8 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 12 | U | 18 | 12 | 5.3 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 9.9 | U | 18 | 9.9 | 3.3 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 5.8 | U | 18 | 5.8 | 1.7 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 12 | U | 18 | 12 | 3.6 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.8 | J | 9.2 | 3.2 | 0.86 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 18 | J | 37 | 15 | 4.7 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.6 | U | 9.2 | 3.6 | 1.5 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.7 | U | 9.2 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.6 | U | 9.2 | 3.6 | 1.4 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.7 | U | 9.2 | 3.7 | 0.98 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 27 | | 9.2 | 3.5 | 1.7 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 42 | M-03 | 9.2 | 7.4 | 2.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 92 | U | 230 | 92 | 38 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 420 | M-03 | 9.2 | 6.7 | 1.7 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 41 | | 9.2 | 3.7 | 1.3 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.5 | U | 9.2 | 3.5 | 1.3 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 26 | M-03 | 9.2 | 3.7 | 0.95 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.7 | U | 9.2 | 3.7 | 1.8 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 4000 | BM-03 | 9.2 | 6.8 | 2.3 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 72 | M-03 | 9.2 | 7.4 | 1.9 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 12 | M-03 | 9.2 | 6.9 | 2.4 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 34 | M-03 | 18 | 3.6 | 1.7 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 18 | U | 46 | 18 | 5.5 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.4 | U | 9.2 | 7.4 | 2.5 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.7 | U | 9.2 | 3.7 | 1.8 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.4 | U | 9.2 | 7.4 | 2.3 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-026
Description: VRTB-L-G4_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024 1125
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 90 | 20-150 | | 106 | 20-150 | H | 86 | 20-150 |
| 13C2-6:2FTS | | 87 | 20-150 | | 96 | 20-150 | H | 82 | 20-150 |
| 13C2-8:2FTS | | 73 | 20-150 | | 75 | 20-150 | H | 77 | 20-150 |
| 13C2-PFDoA | | 63 | 20-150 | M-03 | 63 | 20-150 | H | 70 | 20-150 |
| 13C2-PFTeDA | | 39 | 20-150 | | 42 | 20-150 | H | 39 | 20-150 |
| 13C3-HFPO-DA | | 95 | 20-150 | | 88 | 20-150 | H | 92 | 20-150 |
| 13C3-PFBS | | 98 | 20-150 | | 102 | 20-150 | H | 86 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | | 97 | 20-150 | H | 81 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 | | 88 | 20-150 | H | 88 | 20-150 |
| 13C4-PFHpA | | 90 | 20-150 | | 83 | 20-150 | H | 92 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 90 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 87 | 20-150 | H | 97 | 20-150 |
| 13C6-PFDA | | 82 | 20-150 | | 89 | 20-150 | H | 86 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 | M-03 | 64 | 20-150 | H | 80 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 | | 90 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOS | | 79 | 20-150 | | 94 | 20-150 | H | 79 | 20-150 |
| 13C8-PFOSA | | 104 | 20-150 | | 86 | 20-150 | H | 103 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 | | 86 | 20-150 | H | 89 | 20-150 |
| D3-NMeFOSA | | 81 | 20-150 | M-03 | 70 | 20-150 | H | 62 | 20-150 |
| D3-NMeFOSAA | | 109 | 20-150 | | 85 | 20-150 | H | 106 | 20-150 |
| D5-NEtFOSA | | 77 | 20-150 | M-03 | 61 | 20-150 | H | 62 | 20-150 |
| D5-NEtFOSAA | M-03 | 93 | 20-150 | M-03 | 79 | 20-150 | H | 92 | 20-150 |
| D7-NMeFOSE | | 26 | 20-150 | N | 19 | 20-150 | HN | 5.0 | 20-150 |
| D9-NEtFOSE | N | 5.0 | 20-150 | N | 4.0 | 20-150 | HN | 1.0 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-026

Description: VRTB-L-G4_01252024 | Matrix: Aqueous

Date Sampled: 01/25/2024 1125 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1425 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 10 | 02/23/2024 1034 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 1943 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | UH | 3.8 | 2.2 | 0.84 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | UH | 3.8 | 2.1 | 0.64 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | UH | 3.8 | 2.2 | 0.64 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 72 | HL | 3.8 | 1.4 | 0.59 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | UH | 3.8 | 1.4 | 0.38 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 29 | H | 4.8 | 4.4 | 1.9 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | UH | 24 | 9.6 | 4.1 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | UH | 3.8 | 2.3 | 0.95 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | UH | 0.96 | 0.38 | 0.12 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | UH | 0.96 | 0.77 | 0.28 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UHQ | 9.6 | 1.9 | 0.59 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | UH | 0.96 | 0.77 | 0.21 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | UH | 0.96 | 0.77 | 0.28 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UHQ | 9.6 | 1.9 | 0.61 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UH | 1.9 | 1.2 | 0.55 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | UH | 1.9 | 1.0 | 0.35 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | UH | 1.9 | 0.61 | 0.18 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UH | 1.9 | 1.2 | 0.37 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.0 | H | 0.96 | 0.34 | 0.090 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 17 | H | 3.8 | 1.5 | 0.49 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | UH | 0.96 | 0.37 | 0.16 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.23 | HJM-03 | 0.96 | 0.38 | 0.13 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | UH | 0.96 | 0.37 | 0.15 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | UH | 0.96 | 0.38 | 0.10 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 40 | HM-03 | 0.96 | 0.36 | 0.18 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 42 | H | 0.96 | 0.77 | 0.20 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | UH | 24 | 9.6 | 4.0 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 440 | HM-03 | 0.96 | 0.70 | 0.18 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 41 | H | 0.96 | 0.38 | 0.14 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.17 | HJM-03 | 0.96 | 0.36 | 0.14 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 26 | HM-03 | 0.96 | 0.38 | 0.099 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.8 | HM-03 | 0.96 | 0.38 | 0.19 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 4800 | HEM-03 | 0.96 | 0.71 | 0.24 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 74 | HM-03 | 0.96 | 0.77 | 0.20 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 13 | H | 0.96 | 0.72 | 0.25 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 36 | H | 1.9 | 0.38 | 0.18 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | UH | 4.8 | 1.9 | 0.57 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | UH | 0.96 | 0.77 | 0.26 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | UH | 0.96 | 0.38 | 0.19 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | UH | 0.96 | 0.77 | 0.24 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-026

Description: VRTB-L-G4_01252024 | Matrix: Aqueous

Date Sampled: 01/25/2024 1125 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 90 | 20-150 | | 106 | 20-150 | H | 86 | 20-150 |
| 13C2-6:2FTS | | 87 | 20-150 | | 96 | 20-150 | H | 82 | 20-150 |
| 13C2-8:2FTS | | 73 | 20-150 | | 75 | 20-150 | H | 77 | 20-150 |
| 13C2-PFDoA | | 63 | 20-150 | M-03 | 63 | 20-150 | H | 70 | 20-150 |
| 13C2-PFTeDA | | 39 | 20-150 | | 42 | 20-150 | H | 39 | 20-150 |
| 13C3-HFPO-DA | | 95 | 20-150 | | 88 | 20-150 | H | 92 | 20-150 |
| 13C3-PFBS | | 98 | 20-150 | | 102 | 20-150 | H | 86 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | | 97 | 20-150 | H | 81 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 | | 88 | 20-150 | H | 88 | 20-150 |
| 13C4-PFHpA | | 90 | 20-150 | | 83 | 20-150 | H | 92 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 90 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 87 | 20-150 | H | 97 | 20-150 |
| 13C6-PFDA | | 82 | 20-150 | | 89 | 20-150 | H | 86 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 | M-03 | 64 | 20-150 | H | 80 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 | | 90 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOS | | 79 | 20-150 | | 94 | 20-150 | H | 79 | 20-150 |
| 13C8-PFOSA | | 104 | 20-150 | | 86 | 20-150 | H | 103 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 | | 86 | 20-150 | H | 89 | 20-150 |
| D3-NMeFOSA | | 81 | 20-150 | M-03 | 70 | 20-150 | H | 62 | 20-150 |
| D3-NMeFOSAA | | 109 | 20-150 | | 85 | 20-150 | H | 106 | 20-150 |
| D5-NEtFOSA | | 77 | 20-150 | M-03 | 61 | 20-150 | H | 62 | 20-150 |
| D5-NEtFOSAA | M-03 | 93 | 20-150 | M-03 | 79 | 20-150 | H | 92 | 20-150 |
| D7-NMeFOSE | | 26 | 20-150 | N | 19 | 20-150 | HN | 5.0 | 20-150 |
| D9-NEtFOSE | N | 5.0 | 20-150 | N | 4.0 | 20-150 | HN | 1.0 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-027
Description: VRTB-L-Y3_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 1220 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1434 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 1044 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 2011 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.83 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 77 | | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 6.7 | | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.94 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQ | 9.5 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQ | 9.5 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 4.0 | | 0.95 | 0.33 | 0.089 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.7 | | 3.8 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 17 | | 0.95 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 13 | | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 150 | M-03 | 0.95 | 0.69 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 14 | | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.26 | JM-03 | 0.95 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 8.1 | | 0.95 | 0.38 | 0.098 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.5 | M-03 | 0.95 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1900 | BEM-03 | 0.95 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 25 | M-03 | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 6.3 | | 0.95 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 13 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.76 | UQ | 0.95 | 0.76 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-027
Description: VRTB-L-Y3_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024 1220
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | M-03 | 96 | 20-150 | | 93 | 20-150 | H | 69 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 | | 103 | 20-150 | H | 68 | 20-150 |
| 13C2-8:2FTS | | 69 | 20-150 | M-03 | 84 | 20-150 | H | 65 | 20-150 |
| 13C2-PFDoA | M-03 | 20 | 20-150 | | 22 | 20-150 | H | 71 | 20-150 |
| 13C2-PFTeDA | N | 1.0 | 20-150 | N | 0.00 | 20-150 | H | 57 | 20-150 |
| 13C3-HFPO-DA | | 99 | 20-150 | | 107 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 102 | 20-150 | | 95 | 20-150 | H | 70 | 20-150 |
| 13C3-PFHxS | | 95 | 20-150 | M-03 | 90 | 20-150 | H | 73 | 20-150 |
| 13C4-PFBA | | 97 | 20-150 | | 96 | 20-150 | H | 78 | 20-150 |
| 13C4-PFHpA | | 94 | 20-150 | | 93 | 20-150 | H | 80 | 20-150 |
| 13C5-PFHxA | | 93 | 20-150 | | 96 | 20-150 | H | 80 | 20-150 |
| 13C5-PFPeA | | 94 | 20-150 | | 96 | 20-150 | H | 85 | 20-150 |
| 13C6-PFDA | | 100 | 20-150 | | 95 | 20-150 | H | 84 | 20-150 |
| 13C7-PFUnA | | 82 | 20-150 | | 80 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOA | | 104 | 20-150 | | 89 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOS | | 89 | 20-150 | M-03 | 99 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOSA | | 96 | 20-150 | | 98 | 20-150 | H | 67 | 20-150 |
| 13C9-PFNA | | 96 | 20-150 | | 95 | 20-150 | H | 71 | 20-150 |
| D3-NMeFOSA | | 71 | 20-150 | | 70 | 20-150 | H | 33 | 20-150 |
| D3-NMeFOSAA | | 86 | 20-150 | M-03 | 89 | 20-150 | H | 63 | 20-150 |
| D5-NEtFOSA | | 43 | 20-150 | | 42 | 20-150 | H | 35 | 20-150 |
| D5-NEtFOSAA | | 64 | 20-150 | M-03 | 66 | 20-150 | H | 54 | 20-150 |
| D7-NMeFOSE | N | 0.00 | 20-150 | N | 0.00 | 20-150 | H | 35 | 20-150 |
| D9-NEtFOSE | N | 0.00 | 20-150 | N | 0.00 | 20-150 | HN | 14 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-027
Description: VRTB-L-Y3_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 1220 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1434 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 1044 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 2011 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.2 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.2 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.2 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 60 | | 19 | 7.1 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 22 | U | 24 | 22 | 9.6 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.7 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.61 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.4 | UQ | 47 | 9.4 | 2.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.4 | UQ | 47 | 9.4 | 3.0 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.2 | U | 9.5 | 6.2 | 2.7 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.2 | U | 9.5 | 5.2 | 1.7 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.0 | U | 9.5 | 3.0 | 0.88 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.2 | U | 9.5 | 6.2 | 1.8 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 4.1 | J | 4.7 | 1.6 | 0.45 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 9.0 | JM-03 | 19 | 7.6 | 2.4 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.78 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.64 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.73 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.51 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 13 | | 4.7 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 13 | | 4.7 | 3.8 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 150 | | 4.7 | 3.4 | 0.88 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 15 | | 4.7 | 1.9 | 0.67 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.69 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 8.9 | | 4.7 | 1.9 | 0.49 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.2 | JM-03 | 4.7 | 1.9 | 0.94 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1700 | BM-03 | 4.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 26 | M-03 | 4.7 | 3.8 | 0.99 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 6.8 | | 4.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 12 | | 9.5 | 1.9 | 0.88 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.8 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.8 | UQ | 4.7 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.92 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-027

Description: VRTB-L-Y3_01252024 | Matrix: Aqueous

Date Sampled: 01/25/2024 1220 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | M-03 | 96 | 20-150 | | 93 | 20-150 | H | 69 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 | | 103 | 20-150 | H | 68 | 20-150 |
| 13C2-8:2FTS | | 69 | 20-150 | M-03 | 84 | 20-150 | H | 65 | 20-150 |
| 13C2-PFDoA | M-03 | 20 | 20-150 | | 22 | 20-150 | H | 71 | 20-150 |
| 13C2-PFTeDA | N | 1.0 | 20-150 | N | 0.00 | 20-150 | H | 57 | 20-150 |
| 13C3-HFPO-DA | | 99 | 20-150 | | 107 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 102 | 20-150 | | 95 | 20-150 | H | 70 | 20-150 |
| 13C3-PFHxS | | 95 | 20-150 | M-03 | 90 | 20-150 | H | 73 | 20-150 |
| 13C4-PFBA | | 97 | 20-150 | | 96 | 20-150 | H | 78 | 20-150 |
| 13C4-PFHpA | | 94 | 20-150 | | 93 | 20-150 | H | 80 | 20-150 |
| 13C5-PFHxA | | 93 | 20-150 | | 96 | 20-150 | H | 80 | 20-150 |
| 13C5-PFPeA | | 94 | 20-150 | | 96 | 20-150 | H | 85 | 20-150 |
| 13C6-PFDA | | 100 | 20-150 | | 95 | 20-150 | H | 84 | 20-150 |
| 13C7-PFUnA | | 82 | 20-150 | | 80 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOA | | 104 | 20-150 | | 89 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOS | | 89 | 20-150 | M-03 | 99 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOSA | | 96 | 20-150 | | 98 | 20-150 | H | 67 | 20-150 |
| 13C9-PFNA | | 96 | 20-150 | | 95 | 20-150 | H | 71 | 20-150 |
| D3-NMeFOSA | | 71 | 20-150 | | 70 | 20-150 | H | 33 | 20-150 |
| D3-NMeFOSAA | | 86 | 20-150 | M-03 | 89 | 20-150 | H | 63 | 20-150 |
| D5-NEtFOSA | | 43 | 20-150 | | 42 | 20-150 | H | 35 | 20-150 |
| D5-NEtFOSAA | | 64 | 20-150 | M-03 | 66 | 20-150 | H | 54 | 20-150 |
| D7-NMeFOSE | N | 0.00 | 20-150 | N | 0.00 | 20-150 | H | 35 | 20-150 |
| D9-NEtFOSE | N | 0.00 | 20-150 | N | 0.00 | 20-150 | HN | 14 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-027
Description: VRTB-L-Y3_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 1220 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1434 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 1044 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 2011 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | UH | 20 | 12 | 4.4 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | UH | 20 | 11 | 3.3 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | UH | 20 | 12 | 3.3 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 73 | HLM-03 | 20 | 7.5 | 3.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | UH | 20 | 7.5 | 2.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | UH | 25 | 23 | 10 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | UH | 130 | 52 | 21 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | UH | 20 | 12 | 5.0 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.64 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.5 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | UHQ | 50 | 10 | 3.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.5 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | UH | 50 | 10 | 3.2 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | UH | 10 | 6.5 | 2.9 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | UH | 10 | 5.5 | 1.8 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | UH | 10 | 3.2 | 0.92 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | UH | 10 | 6.5 | 1.9 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 4.9 | HJ | 5.0 | 1.8 | 0.47 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 10 | HJ | 20 | 8.0 | 2.6 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.82 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.68 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.77 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.53 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 19 | HM-03 | 5.0 | 1.9 | 0.95 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 17 | HM-03 | 5.0 | 4.0 | 1.1 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | UH | 130 | 52 | 21 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 170 | HM-03 | 5.0 | 3.7 | 0.92 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 16 | H | 5.0 | 2.0 | 0.71 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | UH | 5.0 | 1.9 | 0.73 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 10 | HM-03 | 5.0 | 2.0 | 0.52 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.9 | HJ | 5.0 | 2.0 | 0.99 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2300 | HM-03 | 5.0 | 3.7 | 1.2 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 33 | HM-03 | 5.0 | 4.0 | 1.0 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 7.9 | HM-03 | 5.0 | 3.8 | 1.3 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 15 | HM-03 | 10 | 2.0 | 0.92 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | UH | 25 | 10 | 3.0 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.3 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.97 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.2 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-027
Description: VRTB-L-Y3_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024 1220
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | M-03 | 96 | 20-150 | | 93 | 20-150 | H | 69 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 | | 103 | 20-150 | H | 68 | 20-150 |
| 13C2-8:2FTS | | 69 | 20-150 | M-03 | 84 | 20-150 | H | 65 | 20-150 |
| 13C2-PFDoA | M-03 | 20 | 20-150 | | 22 | 20-150 | H | 71 | 20-150 |
| 13C2-PFTeDA | N | 1.0 | 20-150 | N | 0.00 | 20-150 | H | 57 | 20-150 |
| 13C3-HFPO-DA | | 99 | 20-150 | | 107 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 102 | 20-150 | | 95 | 20-150 | H | 70 | 20-150 |
| 13C3-PFHxS | | 95 | 20-150 | M-03 | 90 | 20-150 | H | 73 | 20-150 |
| 13C4-PFBA | | 97 | 20-150 | | 96 | 20-150 | H | 78 | 20-150 |
| 13C4-PFHpA | | 94 | 20-150 | | 93 | 20-150 | H | 80 | 20-150 |
| 13C5-PFHxA | | 93 | 20-150 | | 96 | 20-150 | H | 80 | 20-150 |
| 13C5-PFPeA | | 94 | 20-150 | | 96 | 20-150 | H | 85 | 20-150 |
| 13C6-PFDA | | 100 | 20-150 | | 95 | 20-150 | H | 84 | 20-150 |
| 13C7-PFUnA | | 82 | 20-150 | | 80 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOA | | 104 | 20-150 | | 89 | 20-150 | H | 74 | 20-150 |
| 13C8-PFOS | | 89 | 20-150 | M-03 | 99 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOSA | | 96 | 20-150 | | 98 | 20-150 | H | 67 | 20-150 |
| 13C9-PFNA | | 96 | 20-150 | | 95 | 20-150 | H | 71 | 20-150 |
| D3-NMeFOSA | | 71 | 20-150 | | 70 | 20-150 | H | 33 | 20-150 |
| D3-NMeFOSAA | | 86 | 20-150 | M-03 | 89 | 20-150 | H | 63 | 20-150 |
| D5-NEtFOSA | | 43 | 20-150 | | 42 | 20-150 | H | 35 | 20-150 |
| D5-NEtFOSAA | | 64 | 20-150 | M-03 | 66 | 20-150 | H | 54 | 20-150 |
| D7-NMeFOSE | N | 0.00 | 20-150 | N | 0.00 | 20-150 | H | 35 | 20-150 |
| D9-NEtFOSE | N | 0.00 | 20-150 | N | 0.00 | 20-150 | HN | 14 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-028
Description: VRTB-L-S2_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 1255 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1443 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 1053 | ALM | 02/14/2024 1520 | 96443 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.77 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 9.7 | | 3.5 | 1.3 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.3 | JM-03 | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.87 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UQ | 8.8 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | UQ | 8.8 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.3 | | 0.88 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.1 | | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | US | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.094 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 14 | M-03 | 0.88 | 0.33 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 11 | | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 200 | M-03 | 0.88 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 14 | | 0.88 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.33 | U | 0.88 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 4.4 | M-03 | 0.88 | 0.35 | 0.091 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.3 | M-03 | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 950 | BM-03 | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 29 | M-03 | 0.88 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.7 | | 0.88 | 0.66 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 10 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.52 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-028
Description: VRTB-L-S2_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024 1255
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 87 | 20-150 | | 82 | 20-150 |
| 13C2-6:2FTS | | 88 | 20-150 | | 83 | 20-150 |
| 13C2-8:2FTS | | 72 | 20-150 | | 66 | 20-150 |
| 13C2-PFDoA | | 54 | 20-150 | | 62 | 20-150 |
| 13C2-PFTeDA | | 20 | 20-150 | M-03 | 23 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | | 90 | 20-150 |
| 13C3-PFBS | | 91 | 20-150 | | 91 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 | | 90 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 | | 87 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 | | 85 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 | | 81 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 87 | 20-150 |
| 13C6-PFDA | | 76 | 20-150 | | 83 | 20-150 |
| 13C7-PFUnA | | 68 | 20-150 | | 72 | 20-150 |
| 13C8-PFOA | | 84 | 20-150 | | 80 | 20-150 |
| 13C8-PFOS | | 80 | 20-150 | | 79 | 20-150 |
| 13C8-PFOSA | | 76 | 20-150 | | 74 | 20-150 |
| 13C9-PFNA | | 86 | 20-150 | | 76 | 20-150 |
| D3-NMeFOSA | | 55 | 20-150 | | 54 | 20-150 |
| D3-NMeFOSAA | | 77 | 20-150 | | 75 | 20-150 |
| D5-NEtFOSA | | 51 | 20-150 | | 49 | 20-150 |
| D5-NEtFOSAA | | 69 | 20-150 | | 62 | 20-150 |
| D7-NMeFOSE | N | 9.0 | 20-150 | N | 8.0 | 20-150 |
| D9-NEtFOSE | M-03N | 2.0 | 20-150 | N | 2.0 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-029
Description: VRTB-L-B1_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 1405 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1510 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 1102 | ALM | 02/14/2024 1520 | 96443 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.81 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.62 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 0.93 | J | 3.7 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.2 | U | 4.6 | 4.2 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.92 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQ | 9.3 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQ | 9.3 | 1.9 | 0.59 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.8 | | 0.93 | 0.33 | 0.087 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 7.6 | | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.099 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 12 | | 0.93 | 0.35 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 7.7 | M-03 | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 150 | M-03 | 0.93 | 0.68 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 13 | | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.93 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 3.1 | M-03 | 0.93 | 0.37 | 0.096 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 630 | BM-03 | 4.6 | 3.4 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 22 | M-03 | 0.93 | 0.74 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.1 | | 0.93 | 0.70 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 9.5 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-029
Description: VRTB-L-B1_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024 1405
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 91 | 20-150 | | 88 | 20-150 |
| 13C2-6:2FTS | | 88 | 20-150 | | 89 | 20-150 |
| 13C2-8:2FTS | | 72 | 20-150 | | 83 | 20-150 |
| 13C2-PFDoA | | 58 | 20-150 | | 58 | 20-150 |
| 13C2-PFTeDA | | 26 | 20-150 | | 28 | 20-150 |
| 13C3-HFPO-DA | | 96 | 20-150 | | 93 | 20-150 |
| 13C3-PFBS | | 92 | 20-150 | | 97 | 20-150 |
| 13C3-PFHxS | | 91 | 20-150 | | 95 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | | 89 | 20-150 |
| 13C4-PFHpA | | 89 | 20-150 | | 82 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 | | 89 | 20-150 |
| 13C5-PFPeA | | 91 | 20-150 | | 88 | 20-150 |
| 13C6-PFDA | | 86 | 20-150 | | 72 | 20-150 |
| 13C7-PFUnA | | 68 | 20-150 | | 67 | 20-150 |
| 13C8-PFOA | | 92 | 20-150 | | 101 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | | 78 | 20-150 |
| 13C8-PFOSA | | 74 | 20-150 | | 73 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | | 89 | 20-150 |
| D3-NMeFOSA | | 56 | 20-150 | | 55 | 20-150 |
| D3-NMeFOSAA | | 82 | 20-150 | | 75 | 20-150 |
| D5-NEtFOSA | | 49 | 20-150 | M-03 | 45 | 20-150 |
| D5-NEtFOSAA | | 68 | 20-150 | | 67 | 20-150 |
| D7-NMeFOSE | N | 17 | 20-150 | N | 15 | 20-150 |
| D9-NEtFOSE | N | 4.0 | 20-150 | N | 4.0 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-030

Description: DUP-01_01252024 | Matrix: Aqueous

Date Sampled: 01/25/2024 | Project Name: ESTCP Vertebrae

Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1520 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 1111 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 2057 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 60 | | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 130 | | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQ | 9.6 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQ | 9.6 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 21 | | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 54 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 280 | M-03 | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 180 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2600 | EM-03 | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 220 | | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.88 | JM-03 | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 89 | M-03 | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 4.6 | M-03 | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 26000 | BEM-03 | 0.96 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 270 | M-03 | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 67 | | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 130 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-030
Description: DUP-01_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | | 97 | 20-150 | H | 70 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 | | 97 | 20-150 | H | 68 | 20-150 |
| 13C2-8:2FTS | | 85 | 20-150 | | 82 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | M-03 | 66 | 20-150 | | 63 | 20-150 | H | 65 | 20-150 |
| 13C2-PFTeDA | | 39 | 20-150 | | 43 | 20-150 | H | 59 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 | | 98 | 20-150 | H | 67 | 20-150 |
| 13C3-PFBS | | 104 | 20-150 | | 93 | 20-150 | H | 66 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 | | 86 | 20-150 | H | 67 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | | 89 | 20-150 | H | 69 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 | | 85 | 20-150 | H | 66 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 | | 86 | 20-150 | H | 68 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 | | 90 | 20-150 | H | 73 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 | | 89 | 20-150 | H | 69 | 20-150 |
| 13C7-PFUnA | | 71 | 20-150 | | 67 | 20-150 | H | 69 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | | 90 | 20-150 | H | 63 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | | 81 | 20-150 | H | 67 | 20-150 |
| 13C8-PFOSA | | 141 | 20-150 | | 113 | 20-150 | H | 69 | 20-150 |
| 13C9-PFNA | | 84 | 20-150 | | 86 | 20-150 | H | 68 | 20-150 |
| D3-NMeFOSA | | 108 | 20-150 | | 86 | 20-150 | H | 34 | 20-150 |
| D3-NMeFOSAA | M-03 | 141 | 20-150 | | 99 | 20-150 | H | 69 | 20-150 |
| D5-NEtFOSA | | 96 | 20-150 | | 70 | 20-150 | H | 38 | 20-150 |
| D5-NEtFOSAA | | 101 | 20-150 | | 84 | 20-150 | H | 70 | 20-150 |
| D7-NMeFOSE | N | 18 | 20-150 | N | 12 | 20-150 | H | 59 | 20-150 |
| D9-NEtFOSE | N | 4.0 | 20-150 | N | 3.0 | 20-150 | H | 59 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-030
Description: DUP-01_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1520 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 1111 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 2057 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.2 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.2 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.2 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 55 | | 19 | 7.1 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 110 | | 24 | 22 | 9.7 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.62 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.6 | UQ | 48 | 9.6 | 2.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.6 | UQ | 48 | 9.6 | 3.0 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.2 | U | 9.6 | 6.2 | 2.8 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.3 | U | 9.6 | 5.3 | 1.7 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.1 | U | 9.6 | 3.1 | 0.89 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.2 | U | 9.6 | 6.2 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 21 | | 4.8 | 1.7 | 0.45 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 53 | | 19 | 7.6 | 2.4 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.79 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.65 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.74 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.51 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 190 | | 4.8 | 1.8 | 0.91 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 160 | | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2400 | | 4.8 | 3.5 | 0.88 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 230 | | 4.8 | 1.9 | 0.68 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.8 | UM-03 | 4.8 | 1.8 | 0.70 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 74 | | 4.8 | 1.9 | 0.49 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 4.4 | J | 4.8 | 1.9 | 0.95 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 27000 | BEM-03 | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 270 | M-03 | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 64 | | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 120 | | 9.6 | 1.9 | 0.88 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.9 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.93 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-030
Description: DUP-01_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | | 97 | 20-150 | H | 70 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 | | 97 | 20-150 | H | 68 | 20-150 |
| 13C2-8:2FTS | | 85 | 20-150 | | 82 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | M-03 | 66 | 20-150 | | 63 | 20-150 | H | 65 | 20-150 |
| 13C2-PFTeDA | | 39 | 20-150 | | 43 | 20-150 | H | 59 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 | | 98 | 20-150 | H | 67 | 20-150 |
| 13C3-PFBS | | 104 | 20-150 | | 93 | 20-150 | H | 66 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 | | 86 | 20-150 | H | 67 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | | 89 | 20-150 | H | 69 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 | | 85 | 20-150 | H | 66 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 | | 86 | 20-150 | H | 68 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 | | 90 | 20-150 | H | 73 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 | | 89 | 20-150 | H | 69 | 20-150 |
| 13C7-PFUnA | | 71 | 20-150 | | 67 | 20-150 | H | 69 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | | 90 | 20-150 | H | 63 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | | 81 | 20-150 | H | 67 | 20-150 |
| 13C8-PFOSA | | 141 | 20-150 | | 113 | 20-150 | H | 69 | 20-150 |
| 13C9-PFNA | | 84 | 20-150 | | 86 | 20-150 | H | 68 | 20-150 |
| D3-NMeFOSA | | 108 | 20-150 | | 86 | 20-150 | H | 34 | 20-150 |
| D3-NMeFOSAA | M-03 | 141 | 20-150 | | 99 | 20-150 | H | 69 | 20-150 |
| D5-NEtFOSA | | 96 | 20-150 | | 70 | 20-150 | H | 38 | 20-150 |
| D5-NEtFOSAA | | 101 | 20-150 | | 84 | 20-150 | H | 70 | 20-150 |
| D7-NMeFOSE | N | 18 | 20-150 | N | 12 | 20-150 | H | 59 | 20-150 |
| D9-NEtFOSE | N | 4.0 | 20-150 | N | 3.0 | 20-150 | H | 59 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-030
Description: DUP-01_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1520 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 5 | 02/23/2024 1111 | ALM | 02/14/2024 1520 | 96443 |
| 3 | 1633 | 1633 | 1 | 02/26/2024 2057 | ALM | 02/23/2024 1241 | 97077 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 75 | UHL | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 230 | UH | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 21 | HJ | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 49 | HJ | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 170 | H | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 210 | H | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2700 | HM-03 | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 240 | H | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 81 | HM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 27000 | HM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 340 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 62 | H | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 140 | H | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-030
Description: DUP-01_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | | 97 | 20-150 | H | 70 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 | | 97 | 20-150 | H | 68 | 20-150 |
| 13C2-8:2FTS | | 85 | 20-150 | | 82 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | M-03 | 66 | 20-150 | | 63 | 20-150 | H | 65 | 20-150 |
| 13C2-PFTeDA | | 39 | 20-150 | | 43 | 20-150 | H | 59 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 | | 98 | 20-150 | H | 67 | 20-150 |
| 13C3-PFBS | | 104 | 20-150 | | 93 | 20-150 | H | 66 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 | | 86 | 20-150 | H | 67 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | | 89 | 20-150 | H | 69 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 | | 85 | 20-150 | H | 66 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 | | 86 | 20-150 | H | 68 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 | | 90 | 20-150 | H | 73 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 | | 89 | 20-150 | H | 69 | 20-150 |
| 13C7-PFUnA | | 71 | 20-150 | | 67 | 20-150 | H | 69 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 | | 90 | 20-150 | H | 63 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | | 81 | 20-150 | H | 67 | 20-150 |
| 13C8-PFOSA | | 141 | 20-150 | | 113 | 20-150 | H | 69 | 20-150 |
| 13C9-PFNA | | 84 | 20-150 | | 86 | 20-150 | H | 68 | 20-150 |
| D3-NMeFOSA | | 108 | 20-150 | | 86 | 20-150 | H | 34 | 20-150 |
| D3-NMeFOSAA | M-03 | 141 | 20-150 | | 99 | 20-150 | H | 69 | 20-150 |
| D5-NEtFOSA | | 96 | 20-150 | | 70 | 20-150 | H | 38 | 20-150 |
| D5-NEtFOSAA | | 101 | 20-150 | | 84 | 20-150 | H | 70 | 20-150 |
| D7-NMeFOSE | N | 18 | 20-150 | N | 12 | 20-150 | H | 59 | 20-150 |
| D9-NEtFOSE | N | 4.0 | 20-150 | N | 3.0 | 20-150 | H | 59 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZA29006-031
Description: DUP-02_01252024 | Matrix: Aqueous
Date Sampled: 01/25/2024 | Project Name: ESTCP Vertebrae
Date Received: 01/27/2024 | Project Number:

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 02/22/2024 1529 | ALM | 02/14/2024 1520 | 96443 |
| 2 | 1633 | 1633 | 10 | 02/23/2024 1120 | ALM | 02/14/2024 1520 | 96443 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 73 | | 3.8 | 1.4 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 35 | | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.5 | M-03 | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 17 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.21 | JM-03 | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 45 | M-03 | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 40 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 450 | M-03 | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 42 | | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.22 | JM-03 | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 28 | | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.6 | M-03 | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 4500 | BM-03 | 9.6 | 7.1 | 2.4 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 68 | M-03 | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 13 | | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 35 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZA29006-031
Description: DUP-02_01252024
Matrix: Aqueous
Date Sampled: 01/25/2024
Project Name: ESTCP Vertebrae
Date Received: 01/27/2024
Project Number:

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 95 | 20-150 | M-03 | 77 | 20-150 |
| 13C2-6:2FTS | | 84 | 20-150 | | 79 | 20-150 |
| 13C2-8:2FTS | | 73 | 20-150 | M-03 | 76 | 20-150 |
| 13C2-PFDoA | | 62 | 20-150 | | 61 | 20-150 |
| 13C2-PFTeDA | | 39 | 20-150 | | 46 | 20-150 |
| 13C3-HFPO-DA | | 89 | 20-150 | | 77 | 20-150 |
| 13C3-PFBS | | 92 | 20-150 | M-03 | 78 | 20-150 |
| 13C3-PFHxS | | 92 | 20-150 | | 73 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 | | 86 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 | | 75 | 20-150 |
| 13C5-PFHxA | | 82 | 20-150 | | 81 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 | | 82 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 | | 76 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 | | 75 | 20-150 |
| 13C8-PFOA | | 81 | 20-150 | | 76 | 20-150 |
| 13C8-PFOS | | 80 | 20-150 | | 86 | 20-150 |
| 13C8-PFOSA | | 107 | 20-150 | | 93 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 | | 78 | 20-150 |
| D3-NMeFOSA | | 83 | 20-150 | | 77 | 20-150 |
| D3-NMeFOSAA | | 105 | 20-150 | | 81 | 20-150 |
| D5-NEtFOSA | | 81 | 20-150 | | 68 | 20-150 |
| D5-NEtFOSAA | | 80 | 20-150 | | 90 | 20-150 |
| D7-NMeFOSE | | 62 | 20-150 | | 51 | 20-150 |
| D9-NEtFOSE | | 44 | 20-150 | | 37 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96299-001
Batch: 96299
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/12/2024 1531

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 02/15/2024 1915 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 02/15/2024 1915 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 02/15/2024 1915 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 02/15/2024 1915 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 02/15/2024 1915 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 02/15/2024 1915 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 02/15/2024 1915 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 02/15/2024 1915 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 02/15/2024 1915 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/15/2024 1915 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 02/15/2024 1915 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 02/15/2024 1915 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/15/2024 1915 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 02/15/2024 1915 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 02/15/2024 1915 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 02/15/2024 1915 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 02/15/2024 1915 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 02/15/2024 1915 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 02/15/2024 1915 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 02/15/2024 1915 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 02/15/2024 1915 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/15/2024 1915 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 02/15/2024 1915 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 02/15/2024 1915 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 02/15/2024 1915 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/15/2024 1915 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 02/15/2024 1915 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 02/15/2024 1915 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/15/2024 1915 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 02/15/2024 1915 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 02/15/2024 1915 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 02/15/2024 1915 |
| PFOS | 0.51 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 02/15/2024 1915 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/15/2024 1915 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 02/15/2024 1915 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 02/15/2024 1915 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 02/15/2024 1915 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 02/15/2024 1915 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 02/15/2024 1915 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 02/15/2024 1915 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 88 | 20-150 |
| 13C2-6:2FTS | | 86 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96299-001
Batch: 96299
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/12/2024 1531

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 75 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 |
| 13C2-PFTeDA | | 65 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 |
| 13C3-PFBS | | 91 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 |
| 13C5-PFPeA | | 94 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 |
| 13C8-PFOA | | 107 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 |
| 13C8-PFOSA | | 87 | 20-150 |
| 13C9-PFNA | | 88 | 20-150 |
| D3-NMeFOSA | | 66 | 20-150 |
| D3-NMeFOSAA | | 89 | 20-150 |
| D5-NEtFOSA | | 67 | 20-150 |
| D5-NEtFOSAA | | 85 | 20-150 |
| D7-NMeFOSE | | 89 | 20-150 |
| D9-NEtFOSE | | 84 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96299-002
Batch: 96299
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/12/2024 1531

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 99 | | 1 | 109 | 40-150 | 02/16/2024 1552 |
| 9Cl-PF3ONS | 90 | 110 | | 1 | 120 | 40-150 | 02/16/2024 1552 |
| ADONA | 91 | 110 | | 1 | 119 | 40-150 | 02/16/2024 1552 |
| 8:2FTS | 92 | 100 | | 1 | 110 | 40-150 | 02/16/2024 1552 |
| 4:2FTS | 90 | 93 | | 1 | 103 | 40-150 | 02/16/2024 1552 |
| 6:2FTS | 91 | 97 | | 1 | 107 | 40-150 | 02/16/2024 1552 |
| 5:3FTCA | 600 | 670 | | 1 | 112 | 40-150 | 02/16/2024 1552 |
| HFPO-DA | 96 | 100 | | 1 | 108 | 40-150 | 02/16/2024 1552 |
| NEtFOSA | 24 | 25 | | 1 | 104 | 40-150 | 02/16/2024 1552 |
| NEtFOSAA | 24 | 26 | M-03 | 1 | 109 | 40-150 | 02/16/2024 1552 |
| NEtFOSE | 240 | 270 | | 1 | 111 | 40-150 | 02/16/2024 1552 |
| NMeFOSA | 24 | 25 | | 1 | 103 | 40-150 | 02/16/2024 1552 |
| NMeFOSAA | 24 | 27 | M-03 | 1 | 111 | 40-150 | 02/16/2024 1552 |
| NMeFOSE | 240 | 250 | | 1 | 103 | 40-150 | 02/16/2024 1552 |
| NFDHA | 48 | 54 | | 1 | 112 | 40-150 | 02/16/2024 1552 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 44 | | 1 | 103 | 40-150 | 02/16/2024 1552 |
| PFMPA | 48 | 52 | | 1 | 108 | 40-150 | 02/16/2024 1552 |
| PFMBA | 48 | 50 | | 1 | 105 | 40-150 | 02/16/2024 1552 |
| PFBS | 21 | 24 | | 1 | 112 | 40-150 | 02/16/2024 1552 |
| PFBA | 96 | 100 | | 1 | 106 | 40-150 | 02/16/2024 1552 |
| PFDS | 23 | 23 | | 1 | 101 | 40-150 | 02/16/2024 1552 |
| PFDA | 24 | 25 | | 1 | 102 | 40-150 | 02/16/2024 1552 |
| PFDoS | 23 | 20 | | 1 | 85 | 40-150 | 02/16/2024 1552 |
| PFDoA | 24 | 25 | | 1 | 103 | 40-150 | 02/16/2024 1552 |
| PFHpS | 23 | 25 | | 1 | 110 | 40-150 | 02/16/2024 1552 |
| PFHpA | 24 | 26 | | 1 | 109 | 40-150 | 02/16/2024 1552 |
| 7:3FTCA | 600 | 520 | | 1 | 87 | 40-150 | 02/16/2024 1552 |
| PFHxS | 22 | 23 | M-03 | 1 | 106 | 40-150 | 02/16/2024 1552 |
| PFHxA | 24 | 24 | | 1 | 99 | 40-150 | 02/16/2024 1552 |
| PFNS | 23 | 25 | | 1 | 108 | 40-150 | 02/16/2024 1552 |
| PFNA | 24 | 24 | | 1 | 101 | 40-150 | 02/16/2024 1552 |
| PFOSA | 24 | 24 | | 1 | 101 | 40-150 | 02/16/2024 1552 |
| PFOS | 22 | 24 | M-03 | 1 | 106 | 40-150 | 02/16/2024 1552 |
| PFOA | 24 | 25 | | 1 | 102 | 40-150 | 02/16/2024 1552 |
| PFPeS | 23 | 24 | | 1 | 108 | 40-150 | 02/16/2024 1552 |
| PFPeA | 48 | 49 | | 1 | 103 | 40-150 | 02/16/2024 1552 |
| 3:3FTCA | 120 | 140 | | 1 | 114 | 40-150 | 02/16/2024 1552 |
| PFTeDA | 24 | 25 | | 1 | 105 | 40-150 | 02/16/2024 1552 |
| PFTrDA | 24 | 22 | | 1 | 90 | 40-150 | 02/16/2024 1552 |
| PFUnA | 24 | 25 | | 1 | 106 | 40-150 | 02/16/2024 1552 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 89 | 20-150 |
| 13C2-6:2FTS | | 88 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96299-002
Batch: 96299
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/12/2024 1531

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 80 | 20-150 |
| 13C2-PFDoA | M-03 | 87 | 20-150 |
| 13C2-PFTeDA | | 76 | 20-150 |
| 13C3-HFPO-DA | | 94 | 20-150 |
| 13C3-PFBS | | 88 | 20-150 |
| 13C3-PFHxS | | 94 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 |
| 13C4-PFHpA | | 91 | 20-150 |
| 13C5-PFHxA | | 97 | 20-150 |
| 13C5-PFPeA | | 104 | 20-150 |
| 13C6-PFDA | | 94 | 20-150 |
| 13C7-PFUnA | | 89 | 20-150 |
| 13C8-PFOA | | 93 | 20-150 |
| 13C8-PFOS | | 90 | 20-150 |
| 13C8-PFOSA | | 90 | 20-150 |
| 13C9-PFNA | | 89 | 20-150 |
| D3-NMeFOSA | | 74 | 20-150 |
| D3-NMeFOSAA | | 84 | 20-150 |
| D5-NEtFOSA | | 77 | 20-150 |
| D5-NEtFOSAA | | 85 | 20-150 |
| D7-NMeFOSE | | 92 | 20-150 |
| D9-NEtFOSE | | 81 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96299-102
Batch: 96299
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/12/2024 1531

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| 9Cl-PF3ONS | 90 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| ADONA | 91 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| 8:2FTS | 92 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| 4:2FTS | 90 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| 6:2FTS | 91 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| 5:3FTCA | 600 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| HFPO-DA | 96 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| NEtFOSA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| NEtFOSAA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| NEtFOSE | 240 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| NMeFOSA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| NMeFOSAA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| NMeFOSE | 240 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| NFDHA | 48 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFMPA | 48 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFMBA | 48 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFBS | 21 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFBA | 96 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFDS | 23 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFDA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFDoS | 23 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFDoA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFHpS | 23 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFHpA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| 7:3FTCA | 600 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFHxS | 22 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFHxA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFNS | 23 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFNA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFOSA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFOS | 22 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFOA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFPeS | 23 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFPeA | 48 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| 3:3FTCA | 120 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFTeDA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFTrDA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |
| PFUnA | 24 | ND | N | 1 | 0.00 | 40-150 | 02/16/2024 1543 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 96 | 20-150 |
| 13C2-6:2FTS | | 98 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96299-102
Batch: 96299
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/12/2024 1531

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 87 | 20-150 |
| 13C2-PFDoA | | 75 | 20-150 |
| 13C2-PFTeDA | | 68 | 20-150 |
| 13C3-HFPO-DA | | 94 | 20-150 |
| 13C3-PFBS | | 101 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 |
| 13C4-PFBA | | 95 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 |
| 13C5-PFHxA | | 91 | 20-150 |
| 13C5-PFPeA | | 101 | 20-150 |
| 13C6-PFDA | | 90 | 20-150 |
| 13C7-PFUnA | | 81 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 |
| 13C8-PFOS | | 88 | 20-150 |
| 13C8-PFOSA | | 99 | 20-150 |
| 13C9-PFNA | | 90 | 20-150 |
| D3-NMeFOSA | | 74 | 20-150 |
| D3-NMeFOSAA | | 92 | 20-150 |
| D5-NEtFOSA | | 76 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 |
| D7-NMeFOSE | | 93 | 20-150 |
| D9-NEtFOSE | | 82 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: ZA29006-011DU
Batch: 96299
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/12/2024 1531

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| 9Cl-PF3ONS | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| ADONA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| 8:2FTS | 4.4 | 3.6 | JM-03,+ | 1 | 22 | 20 | 02/15/2024 2141 |
| 4:2FTS | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| 6:2FTS | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| 5:3FTCA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| HFPO-DA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| NEtFOSA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| NEtFOSAA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| NEtFOSE | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| NMeFOSA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| NMeFOSAA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| NMeFOSE | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| NFDHA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| PFMPA | 0.19 | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| PFMBA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| PFBS | 8.0 | 7.7 | | 1 | 3.1 | 20 | 02/15/2024 2141 |
| PFBA | 12 | 12 | | 1 | 1.2 | 20 | 02/15/2024 2141 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| PFDA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| PFDoS | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| PFHpS | 36 | 38 | M-03 | 1 | 6.5 | 20 | 02/15/2024 2141 |
| PFHpA | 12 | 11 | | 1 | 7.1 | 20 | 02/15/2024 2141 |
| 7:3FTCA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| PFHxS | 540 | 510 | M-03 | 1 | 6.2 | 20 | 02/15/2024 2141 |
| PFHxA | 27 | 28 | | 1 | 3.6 | 20 | 02/15/2024 2141 |
| PFNS | 0.27 | 0.25 | JM-03 | 1 | 9.1 | 20 | 02/15/2024 2141 |
| PFNA | 5.7 | 4.7 | M-03 | 1 | 19 | 20 | 02/15/2024 2141 |
| PFOSA | 1.5 | 1.5 | M-03 | 1 | 0.040 | 20 | 02/15/2024 2141 |
| PFOS | 1200 | 1200 | EM-03 | 1 | 2.3 | 20 | 02/15/2024 2141 |
| PFOA | 24 | 24 | M-03 | 1 | 0.60 | 20 | 02/15/2024 2141 |
| PFPeS | 15 | 14 | | 1 | 4.3 | 20 | 02/15/2024 2141 |
| PFPeA | 19 | 19 | | 1 | 0.30 | 20 | 02/15/2024 2141 |
| 3:3FTCA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |
| PFUnA | ND | ND | | 1 | 0.00 | 20 | 02/15/2024 2141 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 98 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: ZA29006-011DU
Batch: 96299
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/12/2024 1531

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 77 | 20-150 |
| 13C2-PFDoA | | 76 | 20-150 |
| 13C2-PFTeDA | N | 19 | 20-150 |
| 13C3-HFPO-DA | | 93 | 20-150 |
| 13C3-PFBS | | 96 | 20-150 |
| 13C3-PFHxS | | 93 | 20-150 |
| 13C4-PFBA | | 98 | 20-150 |
| 13C4-PFHpA | | 94 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 |
| 13C5-PFPeA | | 104 | 20-150 |
| 13C6-PFDA | | 92 | 20-150 |
| 13C7-PFUnA | | 86 | 20-150 |
| 13C8-PFOA | | 94 | 20-150 |
| 13C8-PFOS | | 97 | 20-150 |
| 13C8-PFOSA | | 98 | 20-150 |
| 13C9-PFNA | | 95 | 20-150 |
| D3-NMeFOSA | | 80 | 20-150 |
| D3-NMeFOSAA | | 103 | 20-150 |
| D5-NEtFOSA | | 70 | 20-150 |
| D5-NEtFOSAA | | 90 | 20-150 |
| D7-NMeFOSE | N | 4.0 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96346-001
Batch: 96346
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/13/2024 1406

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 02/20/2024 0144 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 02/20/2024 0144 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 02/20/2024 0144 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 02/20/2024 0144 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 02/20/2024 0144 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 02/20/2024 0144 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 02/20/2024 0144 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 02/20/2024 0144 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 02/20/2024 0144 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/20/2024 0144 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 02/20/2024 0144 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 02/20/2024 0144 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/20/2024 0144 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 02/20/2024 0144 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 02/20/2024 0144 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 02/20/2024 0144 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 02/20/2024 0144 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 02/20/2024 0144 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 02/20/2024 0144 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 02/20/2024 0144 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 02/20/2024 0144 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/20/2024 0144 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 02/20/2024 0144 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 02/20/2024 0144 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 02/20/2024 0144 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/20/2024 0144 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 02/20/2024 0144 |
| PFHxS | 0.73 | UM-03 | 1 | 1.0 | 0.73 | 0.18 | ng/L | 02/20/2024 0144 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/20/2024 0144 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 02/20/2024 0144 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 02/20/2024 0144 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 02/20/2024 0144 |
| PFOS | 0.27 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 02/20/2024 0144 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/20/2024 0144 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 02/20/2024 0144 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 02/20/2024 0144 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 02/20/2024 0144 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 02/20/2024 0144 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 02/20/2024 0144 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 02/20/2024 0144 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 77 | 20-150 |
| 13C2-6:2FTS | | 80 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96346-001
Batch: 96346
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/13/2024 1406

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 77 | 20-150 |
| 13C2-PFDoA | | 66 | 20-150 |
| 13C2-PFTeDA | | 67 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 |
| 13C3-PFBS | | 81 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 |
| 13C5-PFHxA | | 84 | 20-150 |
| 13C5-PFPeA | | 86 | 20-150 |
| 13C6-PFDA | | 76 | 20-150 |
| 13C7-PFUnA | M-03 | 71 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 |
| 13C8-PFOSA | | 75 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 |
| D3-NMeFOSA | | 53 | 20-150 |
| D3-NMeFOSAA | | 74 | 20-150 |
| D5-NEtFOSA | | 53 | 20-150 |
| D5-NEtFOSAA | | 69 | 20-150 |
| D7-NMeFOSE | | 72 | 20-150 |
| D9-NEtFOSE | | 66 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96346-002
Batch: 96346
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/13/2024 1406

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 79 | | 1 | 87 | 40-150 | 02/20/2024 0203 |
| 9Cl-PF3ONS | 90 | 82 | | 1 | 92 | 40-150 | 02/20/2024 0203 |
| ADONA | 91 | 98 | | 1 | 108 | 40-150 | 02/20/2024 0203 |
| 8:2FTS | 92 | 98 | | 1 | 107 | 40-150 | 02/20/2024 0203 |
| 4:2FTS | 90 | 86 | | 1 | 96 | 40-150 | 02/20/2024 0203 |
| 6:2FTS | 91 | 88 | | 1 | 96 | 40-150 | 02/20/2024 0203 |
| 5:3FTCA | 600 | 520 | | 1 | 86 | 40-150 | 02/20/2024 0203 |
| HFPO-DA | 96 | 91 | | 1 | 95 | 40-150 | 02/20/2024 0203 |
| NEtFOSA | 24 | 23 | | 1 | 96 | 40-150 | 02/20/2024 0203 |
| NEtFOSAA | 24 | 22 | | 1 | 92 | 40-150 | 02/20/2024 0203 |
| NEtFOSE | 240 | 250 | | 1 | 103 | 40-150 | 02/20/2024 0203 |
| NMeFOSA | 24 | 23 | | 1 | 97 | 40-150 | 02/20/2024 0203 |
| NMeFOSAA | 24 | 21 | M-03 | 1 | 88 | 40-150 | 02/20/2024 0203 |
| NMeFOSE | 240 | 210 | | 1 | 89 | 40-150 | 02/20/2024 0203 |
| NFDHA | 48 | 35 | | 1 | 73 | 40-150 | 02/20/2024 0203 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 40 | | 1 | 94 | 40-150 | 02/20/2024 0203 |
| PFMPA | 48 | 40 | | 1 | 83 | 40-150 | 02/20/2024 0203 |
| PFMBA | 48 | 41 | | 1 | 85 | 40-150 | 02/20/2024 0203 |
| PFBS | 21 | 20 | | 1 | 93 | 40-150 | 02/20/2024 0203 |
| PFBA | 96 | 87 | | 1 | 91 | 40-150 | 02/20/2024 0203 |
| PFDS | 23 | 18 | | 1 | 78 | 40-150 | 02/20/2024 0203 |
| PFDA | 24 | 23 | | 1 | 97 | 40-150 | 02/20/2024 0203 |
| PFDoS | 23 | 17 | | 1 | 72 | 40-150 | 02/20/2024 0203 |
| PFDoA | 24 | 22 | | 1 | 91 | 40-150 | 02/20/2024 0203 |
| PFHpS | 23 | 22 | | 1 | 96 | 40-150 | 02/20/2024 0203 |
| PFHpA | 24 | 22 | | 1 | 90 | 40-150 | 02/20/2024 0203 |
| 7:3FTCA | 600 | 540 | | 1 | 91 | 40-150 | 02/20/2024 0203 |
| PFHxS | 22 | 19 | | 1 | 88 | 40-150 | 02/20/2024 0203 |
| PFHxA | 24 | 22 | | 1 | 92 | 40-150 | 02/20/2024 0203 |
| PFNS | 23 | 20 | | 1 | 87 | 40-150 | 02/20/2024 0203 |
| PFNA | 24 | 23 | | 1 | 95 | 40-150 | 02/20/2024 0203 |
| PFOSA | 24 | 22 | | 1 | 92 | 40-150 | 02/20/2024 0203 |
| PFOS | 22 | 20 | M-03 | 1 | 89 | 40-150 | 02/20/2024 0203 |
| PFOA | 24 | 24 | | 1 | 99 | 40-150 | 02/20/2024 0203 |
| PFPeS | 23 | 20 | | 1 | 89 | 40-150 | 02/20/2024 0203 |
| PFPeA | 48 | 44 | | 1 | 92 | 40-150 | 02/20/2024 0203 |
| 3:3FTCA | 120 | 92 | | 1 | 76 | 40-150 | 02/20/2024 0203 |
| PFTeDA | 24 | 22 | | 1 | 90 | 40-150 | 02/20/2024 0203 |
| PFTrDA | 24 | 21 | | 1 | 89 | 40-150 | 02/20/2024 0203 |
| PFUnA | 24 | 22 | | 1 | 93 | 40-150 | 02/20/2024 0203 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 83 | 20-150 |
| 13C2-6:2FTS | | 81 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96346-002
Batch: 96346
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/13/2024 1406

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 73 | 20-150 |
| 13C2-PFDoA | | 70 | 20-150 |
| 13C2-PFTeDA | | 67 | 20-150 |
| 13C3-HFPO-DA | | 83 | 20-150 |
| 13C3-PFBS | | 86 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 |
| 13C5-PFHxA | | 84 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 |
| 13C6-PFDA | | 77 | 20-150 |
| 13C7-PFUnA | | 75 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 |
| 13C8-PFOSA | | 78 | 20-150 |
| 13C9-PFNA | | 84 | 20-150 |
| D3-NMeFOSA | | 58 | 20-150 |
| D3-NMeFOSAA | | 79 | 20-150 |
| D5-NEtFOSA | | 56 | 20-150 |
| D5-NEtFOSAA | | 73 | 20-150 |
| D7-NMeFOSE | | 73 | 20-150 |
| D9-NEtFOSE | | 68 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96346-102
Batch: 96346
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/13/2024 1406

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.2 | | 1 | 96 | 40-150 | 02/20/2024 0221 |
| 9Cl-PF3ONS | 7.5 | 8.1 | | 1 | 108 | 40-150 | 02/20/2024 0221 |
| ADONA | 7.6 | 8.5 | | 1 | 112 | 40-150 | 02/20/2024 0221 |
| 8:2FTS | 7.7 | 8.9 | | 1 | 116 | 40-150 | 02/20/2024 0221 |
| 4:2FTS | 7.5 | 9.3 | | 1 | 124 | 40-150 | 02/20/2024 0221 |
| 6:2FTS | 7.6 | 8.0 | | 1 | 105 | 40-150 | 02/20/2024 0221 |
| 5:3FTCA | 50 | 46 | | 1 | 91 | 40-150 | 02/20/2024 0221 |
| HFPO-DA | 8.0 | 8.3 | | 1 | 104 | 40-150 | 02/20/2024 0221 |
| NEtFOSA | 2.0 | 2.1 | | 1 | 103 | 40-150 | 02/20/2024 0221 |
| NEtFOSAA | 2.0 | 2.3 | M-03 | 1 | 113 | 40-150 | 02/20/2024 0221 |
| NEtFOSE | 20 | 22 | | 1 | 110 | 40-150 | 02/20/2024 0221 |
| NMeFOSA | 2.0 | 2.2 | | 1 | 108 | 40-150 | 02/20/2024 0221 |
| NMeFOSAA | 2.0 | 2.1 | M-03 | 1 | 106 | 40-150 | 02/20/2024 0221 |
| NMeFOSE | 20 | 22 | | 1 | 108 | 40-150 | 02/20/2024 0221 |
| NFDHA | 4.0 | 3.3 | M-03 | 1 | 82 | 40-150 | 02/20/2024 0221 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.8 | | 1 | 107 | 40-150 | 02/20/2024 0221 |
| PFMPA | 4.0 | 4.0 | | 1 | 100 | 40-150 | 02/20/2024 0221 |
| PFMBA | 4.0 | 4.0 | | 1 | 99 | 40-150 | 02/20/2024 0221 |
| PFBS | 1.8 | 1.8 | | 1 | 102 | 40-150 | 02/20/2024 0221 |
| PFBA | 8.0 | 8.7 | | 1 | 108 | 40-150 | 02/20/2024 0221 |
| PFDS | 1.9 | 1.8 | | 1 | 91 | 40-150 | 02/20/2024 0221 |
| PFDA | 2.0 | 1.9 | | 1 | 97 | 40-150 | 02/20/2024 0221 |
| PFDoS | 1.9 | 1.6 | M-03 | 1 | 83 | 40-150 | 02/20/2024 0221 |
| PFDoA | 2.0 | 2.0 | | 1 | 102 | 40-150 | 02/20/2024 0221 |
| PFHpS | 1.9 | 2.2 | | 1 | 114 | 40-150 | 02/20/2024 0221 |
| PFHpA | 2.0 | 2.1 | | 1 | 105 | 40-150 | 02/20/2024 0221 |
| 7:3FTCA | 50 | 45 | | 1 | 90 | 40-150 | 02/20/2024 0221 |
| PFHxS | 1.8 | 2.1 | M-03 | 1 | 113 | 40-150 | 02/20/2024 0221 |
| PFHxA | 2.0 | 2.3 | | 1 | 115 | 40-150 | 02/20/2024 0221 |
| PFNS | 1.9 | 2.0 | | 1 | 104 | 40-150 | 02/20/2024 0221 |
| PFNA | 2.0 | 2.5 | | 1 | 127 | 40-150 | 02/20/2024 0221 |
| PFOSA | 2.0 | 2.1 | M-03 | 1 | 106 | 40-150 | 02/20/2024 0221 |
| PFOS | 1.9 | 1.8 | | 1 | 99 | 40-150 | 02/20/2024 0221 |
| PFOA | 2.0 | 2.1 | M-03 | 1 | 107 | 40-150 | 02/20/2024 0221 |
| PFPeS | 1.9 | 2.0 | | 1 | 108 | 40-150 | 02/20/2024 0221 |
| PFPeA | 4.0 | 4.4 | | 1 | 110 | 40-150 | 02/20/2024 0221 |
| 3:3FTCA | 10 | 8.2 | | 1 | 82 | 40-150 | 02/20/2024 0221 |
| PFTeDA | 2.0 | 1.9 | | 1 | 95 | 40-150 | 02/20/2024 0221 |
| PFTrDA | 2.0 | 2.1 | M-03 | 1 | 107 | 40-150 | 02/20/2024 0221 |
| PFUnA | 2.0 | 2.3 | M-03 | 1 | 117 | 40-150 | 02/20/2024 0221 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 72 | 20-150 |
| 13C2-6:2FTS | | 72 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96346-102
Batch: 96346
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/13/2024 1406

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 65 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 |
| 13C2-PFTeDA | | 55 | 20-150 |
| 13C3-HFPO-DA | | 71 | 20-150 |
| 13C3-PFBS | | 74 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 |
| 13C4-PFBA | | 71 | 20-150 |
| 13C4-PFHpA | | 70 | 20-150 |
| 13C5-PFHxA | | 73 | 20-150 |
| 13C5-PFPeA | | 79 | 20-150 |
| 13C6-PFDA | | 67 | 20-150 |
| 13C7-PFUnA | M-03 | 62 | 20-150 |
| 13C8-PFOA | | 68 | 20-150 |
| 13C8-PFOS | | 66 | 20-150 |
| 13C8-PFOSA | | 62 | 20-150 |
| 13C9-PFNA | | 64 | 20-150 |
| D3-NMeFOSA | | 45 | 20-150 |
| D3-NMeFOSAA | | 62 | 20-150 |
| D5-NEtFOSA | | 43 | 20-150 |
| D5-NEtFOSAA | | 59 | 20-150 |
| D7-NMeFOSE | | 60 | 20-150 |
| D9-NEtFOSE | | 58 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: ZA29006-014DU
Batch: 96346
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/13/2024 1406

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| 9Cl-PF3ONS | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| ADONA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| 8:2FTS | 11 | 12 | M-03 | 1 | 6.9 | 20 | 02/20/2024 0642 |
| 4:2FTS | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| 6:2FTS | 52 | 55 | | 1 | 5.7 | 20 | 02/20/2024 0642 |
| 5:3FTCA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| HFPO-DA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| NEtFOSA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| NEtFOSAA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| NEtFOSE | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| NMeFOSA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| NMeFOSAA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| NMeFOSE | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| NFDHA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFMPA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFMBA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFBS | 18 | 19 | | 1 | 6.9 | 20 | 02/20/2024 0642 |
| PFBA | 79 | 88 | | 1 | 11 | 20 | 02/20/2024 0642 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFDA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFDoS | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFHpS | 190 | 200 | M-03 | 1 | 7.2 | 20 | 02/20/2024 0642 |
| PFHpA | 170 | 180 | | 1 | 4.3 | 20 | 02/20/2024 0642 |
| 7:3FTCA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFHxS | 1400 | 1600 | E | 1 | 7.7 | 20 | 02/20/2024 0642 |
| PFHxA | 230 | 250 | | 1 | 7.4 | 20 | 02/20/2024 0642 |
| PFNS | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFNA | 49 | 48 | M-03 | 1 | 0.80 | 20 | 02/20/2024 0642 |
| PFOSA | 0.97 | 0.93 | JM-03 | 1 | 4.2 | 20 | 02/20/2024 0642 |
| PFOS | 9700 | 11000 | EM-03 | 1 | 9.1 | 20 | 02/20/2024 0642 |
| PFOA | 200 | 210 | | 1 | 4.5 | 20 | 02/20/2024 0642 |
| PFPeS | 64 | 70 | | 1 | 9.2 | 20 | 02/20/2024 0642 |
| PFPeA | 190 | 210 | | 1 | 7.3 | 20 | 02/20/2024 0642 |
| 3:3FTCA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |
| PFUnA | ND | ND | | 1 | 0.00 | 20 | 02/20/2024 0642 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 120 | 20-150 |
| 13C2-6:2FTS | | 96 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: ZA29006-014DU
Batch: 96346
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/13/2024 1406

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 88 | 20-150 |
| 13C2-PFDoA | | 52 | 20-150 |
| 13C2-PFTeDA | | 47 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 |
| 13C3-PFBS | | 110 | 20-150 |
| 13C3-PFHxS | | 74 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 |
| 13C6-PFDA | | 74 | 20-150 |
| 13C7-PFUnA | M-03 | 66 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 |
| 13C8-PFOS | M-03 | 81 | 20-150 |
| 13C8-PFOSA | N | 185 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 |
| D3-NMeFOSA | | 136 | 20-150 |
| D3-NMeFOSAA | | 120 | 20-150 |
| D5-NEtFOSA | | 120 | 20-150 |
| D5-NEtFOSAA | | 71 | 20-150 |
| D7-NMeFOSE | M-03 | 131 | 20-150 |
| D9-NEtFOSE | | 86 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZA29006-021MS
Batch: 96346
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/13/2024 1406

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 15 | 62 | N | 1 | 413 | 40-150 | 02/20/2024 1331 |
| 9Cl-PF3ONS | ND | 15 | 78 | N | 1 | 524 | 40-150 | 02/20/2024 1331 |
| ADONA | ND | 15 | 96 | N | 1 | 635 | 40-150 | 02/20/2024 1331 |
| 8:2FTS | 2.2 | 15 | 83 | N | 1 | 529 | 40-150 | 02/20/2024 1331 |
| 4:2FTS | ND | 15 | 81 | N | 1 | 544 | 40-150 | 02/20/2024 1331 |
| 6:2FTS | 59 | 15 | 140 | N | 1 | 518 | 40-150 | 02/20/2024 1331 |
| 5:3FTCA | ND | 15 | 620 | N | 1 | 4170 | 40-150 | 02/20/2024 1331 |
| HFPO-DA | ND | 32 | 90 | N | 1 | 282 | 40-150 | 02/20/2024 1331 |
| NEtFOSA | ND | 16 | 20 | | 1 | 124 | 40-150 | 02/20/2024 1331 |
| NEtFOSAA | ND | 16 | 21 | | 1 | 130 | 40-150 | 02/20/2024 1331 |
| NEtFOSE | ND | 16 | 200 | N | 1 | 1270 | 40-150 | 02/20/2024 1331 |
| NMeFOSA | ND | 16 | 20 | | 1 | 127 | 40-150 | 02/20/2024 1331 |
| NMeFOSAA | ND | 16 | 19 | M-03 | 1 | 119 | 40-150 | 02/20/2024 1331 |
| NMeFOSE | ND | 16 | 190 | N | 1 | 1210 | 40-150 | 02/20/2024 1331 |
| NFDHA | ND | 15 | 38 | N | 1 | 254 | 40-150 | 02/20/2024 1331 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 15 | 44 | N | 1 | 294 | 40-150 | 02/20/2024 1331 |
| PFMPA | ND | 15 | 46 | N | 1 | 313 | 40-150 | 02/20/2024 1331 |
| PFMBA | ND | 15 | 44 | N | 1 | 295 | 40-150 | 02/20/2024 1331 |
| PFBS | 11 | 14 | 28 | | 1 | 120 | 40-150 | 02/20/2024 1331 |
| PFBA | 25 | 16 | 100 | N | 1 | 487 | 40-150 | 02/20/2024 1331 |
| PFDS | ND | 15 | 21 | | 1 | 135 | 40-150 | 02/20/2024 1331 |
| PFDA | ND | 16 | 21 | | 1 | 128 | 40-150 | 02/20/2024 1331 |
| PFDoS | ND | 15 | 11 | | 1 | 70 | 40-150 | 02/20/2024 1331 |
| PFDoA | ND | 16 | 19 | | 1 | 117 | 40-150 | 02/20/2024 1331 |
| PFHpS | 42 | 15 | 71 | N | 1 | 191 | 40-150 | 02/20/2024 1331 |
| PFHpA | 100 | 16 | 120 | | 1 | 102 | 40-150 | 02/20/2024 1331 |
| 7:3FTCA | ND | 15 | 640 | N | 1 | 4280 | 40-150 | 02/20/2024 1331 |
| PFHxS | 1000 | 15 | 980 | NM-03 | 1 | -162 | 40-150 | 02/20/2024 1331 |
| PFHxA | 81 | 20 | 110 | | 1 | 126 | 40-150 | 02/20/2024 1331 |
| PFNS | ND | 15 | 24 | N | 1 | 158 | 40-150 | 02/20/2024 1331 |
| PFNA | 15 | 16 | 37 | M-03 | 1 | 135 | 40-150 | 02/20/2024 1331 |
| PFOSA | ND | 16 | 20 | M-03 | 1 | 123 | 40-150 | 02/20/2024 1331 |
| PFOS | 2000 | 15 | 2000 | N | 1 | -392 | 40-150 | 02/20/2024 1331 |
| PFOA | 120 | 16 | 140 | | 1 | 127 | 40-150 | 02/20/2024 1331 |
| PFPeS | 38 | 15 | 60 | | 1 | 145 | 40-150 | 02/20/2024 1331 |
| PFPeA | 62 | 16 | 100 | N | 1 | 242 | 40-150 | 02/20/2024 1331 |
| 3:3FTCA | ND | 15 | 110 | N | 1 | 733 | 40-150 | 02/20/2024 1331 |
| PFTeDA | ND | 16 | 20 | M-03 | 1 | 127 | 40-150 | 02/20/2024 1331 |
| PFTrDA | ND | 16 | 15 | | 1 | 92 | 40-150 | 02/20/2024 1331 |
| PFUnA | ND | 16 | 20 | | 1 | 127 | 40-150 | 02/20/2024 1331 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 140 | 20-150 |
| 13C2-6:2FTS | | 102 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZA29006-021MS
Batch: 96346
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/13/2024 1406

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 98 | 20-150 |
| 13C2-PFDoA | | 64 | 20-150 |
| 13C2-PFTeDA | | 32 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 |
| 13C3-PFBS | | 111 | 20-150 |
| 13C3-PFHxS | | 88 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 |
| 13C4-PFHpA | | 89 | 20-150 |
| 13C5-PFHxA | | 91 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 |
| 13C7-PFUnA | | 74 | 20-150 |
| 13C8-PFOA | | 90 | 20-150 |
| 13C8-PFOS | | 89 | 20-150 |
| 13C8-PFOSA | | 109 | 20-150 |
| 13C9-PFNA | | 82 | 20-150 |
| D3-NMeFOSA | | 83 | 20-150 |
| D3-NMeFOSAA | | 94 | 20-150 |
| D5-NEtFOSA | | 73 | 20-150 |
| D5-NEtFOSAA | | 70 | 20-150 |
| D7-NMeFOSE | | 52 | 20-150 |
| D9-NEtFOSE | | 23 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96443-001
Batch: 96443
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/14/2024 1520

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 02/22/2024 1330 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 02/22/2024 1330 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 02/22/2024 1330 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 02/22/2024 1330 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 02/22/2024 1330 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 02/22/2024 1330 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 02/22/2024 1330 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 02/22/2024 1330 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 02/22/2024 1330 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/22/2024 1330 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 02/22/2024 1330 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 02/22/2024 1330 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/22/2024 1330 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 02/22/2024 1330 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 02/22/2024 1330 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 02/22/2024 1330 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 02/22/2024 1330 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 02/22/2024 1330 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 02/22/2024 1330 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 02/22/2024 1330 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 02/22/2024 1330 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/22/2024 1330 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 02/22/2024 1330 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 02/22/2024 1330 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 02/22/2024 1330 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/22/2024 1330 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 02/22/2024 1330 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 02/22/2024 1330 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/22/2024 1330 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 02/22/2024 1330 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 02/22/2024 1330 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 02/22/2024 1330 |
| PFOS | 0.40 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 02/22/2024 1330 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/22/2024 1330 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 02/22/2024 1330 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 02/22/2024 1330 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 02/22/2024 1330 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 02/22/2024 1330 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 02/22/2024 1330 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 02/22/2024 1330 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 83 | 20-150 |
| 13C2-6:2FTS | | 83 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96443-001
Batch: 96443
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/14/2024 1520

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 81 | 20-150 |
| 13C2-PFDoA | | 79 | 20-150 |
| 13C2-PFTeDA | | 77 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 |
| 13C3-PFBS | | 87 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 |
| 13C4-PFBA | | 83 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 |
| 13C5-PFHxA | | 82 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 |
| 13C6-PFDA | | 83 | 20-150 |
| 13C7-PFUnA | | 76 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 |
| 13C8-PFOS | | 83 | 20-150 |
| 13C8-PFOSA | | 82 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 |
| D3-NMeFOSA | | 68 | 20-150 |
| D3-NMeFOSAA | | 84 | 20-150 |
| D5-NEtFOSA | | 70 | 20-150 |
| D5-NEtFOSAA | | 78 | 20-150 |
| D7-NMeFOSE | | 80 | 20-150 |
| D9-NEtFOSE | | 78 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96443-002
Batch: 96443
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/14/2024 1520

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 97 | | 1 | 107 | 40-150 | 02/22/2024 1339 |
| 9Cl-PF3ONS | 90 | 100 | | 1 | 112 | 40-150 | 02/22/2024 1339 |
| ADONA | 91 | 110 | | 1 | 117 | 40-150 | 02/22/2024 1339 |
| 8:2FTS | 92 | 99 | | 1 | 107 | 40-150 | 02/22/2024 1339 |
| 4:2FTS | 90 | 97 | | 1 | 108 | 40-150 | 02/22/2024 1339 |
| 6:2FTS | 91 | 96 | | 1 | 105 | 40-150 | 02/22/2024 1339 |
| 5:3FTCA | 600 | 740 | | 1 | 123 | 40-150 | 02/22/2024 1339 |
| HFPO-DA | 96 | 100 | | 1 | 109 | 40-150 | 02/22/2024 1339 |
| NEtFOSA | 24 | 25 | | 1 | 102 | 40-150 | 02/22/2024 1339 |
| NEtFOSAA | 24 | 24 | M-03 | 1 | 102 | 40-150 | 02/22/2024 1339 |
| NEtFOSE | 240 | 260 | | 1 | 108 | 40-150 | 02/22/2024 1339 |
| NMeFOSA | 24 | 26 | | 1 | 110 | 40-150 | 02/22/2024 1339 |
| NMeFOSAA | 24 | 29 | M-03 | 1 | 120 | 40-150 | 02/22/2024 1339 |
| NMeFOSE | 240 | 260 | | 1 | 109 | 40-150 | 02/22/2024 1339 |
| NFDHA | 48 | 53 | | 1 | 110 | 40-150 | 02/22/2024 1339 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 51 | | 1 | 118 | 40-150 | 02/22/2024 1339 |
| PFMPA | 48 | 54 | | 1 | 113 | 40-150 | 02/22/2024 1339 |
| PFMBA | 48 | 51 | | 1 | 106 | 40-150 | 02/22/2024 1339 |
| PFBS | 21 | 22 | | 1 | 102 | 40-150 | 02/22/2024 1339 |
| PFBA | 96 | 100 | | 1 | 106 | 40-150 | 02/22/2024 1339 |
| PFDS | 23 | 22 | | 1 | 96 | 40-150 | 02/22/2024 1339 |
| PFDA | 24 | 28 | | 1 | 116 | 40-150 | 02/22/2024 1339 |
| PFDoS | 23 | 21 | | 1 | 90 | 40-150 | 02/22/2024 1339 |
| PFDoA | 24 | 27 | | 1 | 111 | 40-150 | 02/22/2024 1339 |
| PFHpS | 23 | 23 | | 1 | 103 | 40-150 | 02/22/2024 1339 |
| PFHpA | 24 | 24 | | 1 | 101 | 40-150 | 02/22/2024 1339 |
| 7:3FTCA | 600 | 770 | | 1 | 128 | 40-150 | 02/22/2024 1339 |
| PFHxS | 22 | 24 | M-03 | 1 | 111 | 40-150 | 02/22/2024 1339 |
| PFHxA | 24 | 26 | | 1 | 107 | 40-150 | 02/22/2024 1339 |
| PFNS | 23 | 23 | | 1 | 102 | 40-150 | 02/22/2024 1339 |
| PFNA | 24 | 25 | | 1 | 104 | 40-150 | 02/22/2024 1339 |
| PFOSA | 24 | 26 | | 1 | 106 | 40-150 | 02/22/2024 1339 |
| PFOS | 22 | 23 | M-03 | 1 | 102 | 40-150 | 02/22/2024 1339 |
| PFOA | 24 | 24 | | 1 | 98 | 40-150 | 02/22/2024 1339 |
| PFPeS | 23 | 25 | | 1 | 112 | 40-150 | 02/22/2024 1339 |
| PFPeA | 48 | 51 | | 1 | 107 | 40-150 | 02/22/2024 1339 |
| 3:3FTCA | 120 | 140 | | 1 | 118 | 40-150 | 02/22/2024 1339 |
| PFTeDA | 24 | 26 | | 1 | 107 | 40-150 | 02/22/2024 1339 |
| PFTrDA | 24 | 24 | | 1 | 100 | 40-150 | 02/22/2024 1339 |
| PFUnA | 24 | 29 | | 1 | 121 | 40-150 | 02/22/2024 1339 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 82 | 20-150 |
| 13C2-6:2FTS | | 84 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96443-002
Batch: 96443
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/14/2024 1520

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 76 | 20-150 |
| 13C2-PFDoA | | 79 | 20-150 |
| 13C2-PFTeDA | | 74 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 |
| 13C3-PFBS | | 87 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 |
| 13C4-PFHpA | | 87 | 20-150 |
| 13C5-PFHxA | | 82 | 20-150 |
| 13C5-PFPeA | | 82 | 20-150 |
| 13C6-PFDA | | 80 | 20-150 |
| 13C7-PFUnA | | 72 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 |
| 13C8-PFOS | | 85 | 20-150 |
| 13C8-PFOSA | | 81 | 20-150 |
| 13C9-PFNA | | 84 | 20-150 |
| D3-NMeFOSA | | 70 | 20-150 |
| D3-NMeFOSAA | | 80 | 20-150 |
| D5-NEtFOSA | | 75 | 20-150 |
| D5-NEtFOSAA | | 85 | 20-150 |
| D7-NMeFOSE | | 79 | 20-150 |
| D9-NEtFOSE | | 78 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96443-102
Batch: 96443
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/14/2024 1520

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 8.4 | | 1 | 111 | 40-150 | 02/22/2024 1348 |
| 9Cl-PF3ONS | 7.5 | 8.6 | | 1 | 115 | 40-150 | 02/22/2024 1348 |
| ADONA | 7.6 | 9.1 | | 1 | 120 | 40-150 | 02/22/2024 1348 |
| 8:2FTS | 7.7 | 9.6 | M-03 | 1 | 126 | 40-150 | 02/22/2024 1348 |
| 4:2FTS | 7.5 | 9.4 | | 1 | 126 | 40-150 | 02/22/2024 1348 |
| 6:2FTS | 7.6 | 9.7 | M-03 | 1 | 128 | 40-150 | 02/22/2024 1348 |
| 5:3FTCA | 50 | 56 | | 1 | 112 | 40-150 | 02/22/2024 1348 |
| HFPO-DA | 8.0 | 9.3 | | 1 | 116 | 40-150 | 02/22/2024 1348 |
| NEtFOSA | 2.0 | 2.2 | | 1 | 109 | 40-150 | 02/22/2024 1348 |
| NEtFOSAA | 2.0 | 1.8 | M-03 | 1 | 88 | 40-150 | 02/22/2024 1348 |
| NEtFOSE | 20 | 22 | | 1 | 111 | 40-150 | 02/22/2024 1348 |
| NMeFOSA | 2.0 | 2.0 | | 1 | 99 | 40-150 | 02/22/2024 1348 |
| NMeFOSAA | 2.0 | 2.1 | M-03 | 1 | 104 | 40-150 | 02/22/2024 1348 |
| NMeFOSE | 20 | 22 | | 1 | 112 | 40-150 | 02/22/2024 1348 |
| NFDHA | 4.0 | 4.6 | | 1 | 115 | 40-150 | 02/22/2024 1348 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.1 | | 1 | 114 | 40-150 | 02/22/2024 1348 |
| PFMPA | 4.0 | 5.0 | | 1 | 125 | 40-150 | 02/22/2024 1348 |
| PFMBA | 4.0 | 4.6 | | 1 | 114 | 40-150 | 02/22/2024 1348 |
| PFBS | 1.8 | 2.1 | | 1 | 119 | 40-150 | 02/22/2024 1348 |
| PFBA | 8.0 | 9.3 | | 1 | 117 | 40-150 | 02/22/2024 1348 |
| PFDS | 1.9 | 2.2 | | 1 | 113 | 40-150 | 02/22/2024 1348 |
| PFDA | 2.0 | 2.3 | M-03 | 1 | 113 | 40-150 | 02/22/2024 1348 |
| PFDoS | 1.9 | 2.0 | | 1 | 105 | 40-150 | 02/22/2024 1348 |
| PFDoA | 2.0 | 2.3 | M-03 | 1 | 113 | 40-150 | 02/22/2024 1348 |
| PFHpS | 1.9 | 2.4 | M-03 | 1 | 124 | 40-150 | 02/22/2024 1348 |
| PFHpA | 2.0 | 2.4 | | 1 | 120 | 40-150 | 02/22/2024 1348 |
| 7:3FTCA | 50 | 52 | | 1 | 104 | 40-150 | 02/22/2024 1348 |
| PFHxS | 1.8 | 2.1 | M-03 | 1 | 113 | 40-150 | 02/22/2024 1348 |
| PFHxA | 2.0 | 2.2 | | 1 | 111 | 40-150 | 02/22/2024 1348 |
| PFNS | 1.9 | 2.2 | M-03 | 1 | 116 | 40-150 | 02/22/2024 1348 |
| PFNA | 2.0 | 2.6 | M-03 | 1 | 129 | 40-150 | 02/22/2024 1348 |
| PFOSA | 2.0 | 2.3 | | 1 | 114 | 40-150 | 02/22/2024 1348 |
| PFOS | 1.9 | 2.5 | M-03 | 1 | 137 | 40-150 | 02/22/2024 1348 |
| PFOA | 2.0 | 2.2 | M-03 | 1 | 112 | 40-150 | 02/22/2024 1348 |
| PFPeS | 1.9 | 2.5 | M-03 | 1 | 133 | 40-150 | 02/22/2024 1348 |
| PFPeA | 4.0 | 4.7 | M-03 | 1 | 118 | 40-150 | 02/22/2024 1348 |
| 3:3FTCA | 10 | 12 | | 1 | 120 | 40-150 | 02/22/2024 1348 |
| PFTeDA | 2.0 | 2.5 | | 1 | 123 | 40-150 | 02/22/2024 1348 |
| PFTrDA | 2.0 | 2.4 | M-03 | 1 | 122 | 40-150 | 02/22/2024 1348 |
| PFUnA | 2.0 | 2.4 | | 1 | 121 | 40-150 | 02/22/2024 1348 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 80 | 20-150 |
| 13C2-6:2FTS | | 85 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96443-102
Batch: 96443
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/14/2024 1520

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 76 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 |
| 13C2-PFTeDA | | 80 | 20-150 |
| 13C3-HFPO-DA | | 86 | 20-150 |
| 13C3-PFBS | | 86 | 20-150 |
| 13C3-PFHxS | | 82 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 |
| 13C5-PFHxA | | 86 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 |
| 13C6-PFDA | | 85 | 20-150 |
| 13C7-PFUnA | | 78 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 |
| 13C8-PFOSA | | 82 | 20-150 |
| 13C9-PFNA | | 81 | 20-150 |
| D3-NMeFOSA | | 69 | 20-150 |
| D3-NMeFOSAA | | 84 | 20-150 |
| D5-NEtFOSA | | 74 | 20-150 |
| D5-NEtFOSAA | | 81 | 20-150 |
| D7-NMeFOSE | | 79 | 20-150 |
| D9-NEtFOSE | | 78 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZA29006-028MS
Batch: 96443
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/14/2024 1520

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 86 | 69 | | 1 | 81 | 40-150 | 02/22/2024 1452 |
| 9Cl-PF3ONS | ND | 85 | 92 | | 1 | 108 | 40-150 | 02/22/2024 1452 |
| ADONA | ND | 86 | 99 | | 1 | 115 | 40-150 | 02/22/2024 1452 |
| 8:2FTS | 9.7 | 87 | 90 | | 1 | 93 | 40-150 | 02/22/2024 1452 |
| 4:2FTS | ND | 85 | 88 | | 1 | 103 | 40-150 | 02/22/2024 1452 |
| 6:2FTS | 4.3 | 86 | 92 | | 1 | 102 | 40-150 | 02/22/2024 1452 |
| 5:3FTCA | ND | 570 | 670 | | 1 | 118 | 40-150 | 02/22/2024 1452 |
| HFPO-DA | ND | 91 | 98 | | 1 | 108 | 40-150 | 02/22/2024 1452 |
| NEtFOSA | ND | 23 | 21 | | 1 | 93 | 40-150 | 02/22/2024 1452 |
| NEtFOSAA | ND | 23 | 22 | M-03 | 1 | 99 | 40-150 | 02/22/2024 1452 |
| NEtFOSE | ND | 230 | 190 | | 1 | 83 | 40-150 | 02/22/2024 1452 |
| NMeFOSA | ND | 23 | 21 | | 1 | 95 | 40-150 | 02/22/2024 1452 |
| NMeFOSAA | ND | 23 | 24 | M-03 | 1 | 104 | 40-150 | 02/22/2024 1452 |
| NMeFOSE | ND | 230 | 210 | | 1 | 93 | 40-150 | 02/22/2024 1452 |
| NFDHA | ND | 45 | 45 | | 1 | 100 | 40-150 | 02/22/2024 1452 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 40 | 39 | | 1 | 97 | 40-150 | 02/22/2024 1452 |
| PFMPA | ND | 45 | 46 | | 1 | 101 | 40-150 | 02/22/2024 1452 |
| PFMBA | ND | 45 | 43 | | 1 | 95 | 40-150 | 02/22/2024 1452 |
| PFBS | 5.3 | 20 | 25 | | 1 | 98 | 40-150 | 02/22/2024 1452 |
| PFBA | 8.1 | 91 | 95 | | 1 | 96 | 40-150 | 02/22/2024 1452 |
| PFDS | ND | 22 | 19 | | 1 | 86 | 40-150 | 02/22/2024 1452 |
| PFDA | ND | 23 | 23 | | 1 | 100 | 40-150 | 02/22/2024 1452 |
| PFDoS | ND | 22 | 9.2 | | 1 | 42 | 40-150 | 02/22/2024 1452 |
| PFDoA | ND | 23 | 21 | | 1 | 94 | 40-150 | 02/22/2024 1452 |
| PFHpS | 14 | 22 | 40 | M-03 | 1 | 118 | 40-150 | 02/22/2024 1452 |
| PFHpA | 11 | 23 | 33 | | 1 | 99 | 40-150 | 02/22/2024 1452 |
| 7:3FTCA | ND | 570 | 600 | | 1 | 106 | 40-150 | 02/22/2024 1452 |
| PFHxS | 200 | 21 | 220 | M-03 | 1 | 108 | 40-150 | 02/22/2024 1452 |
| PFHxA | 14 | 23 | 36 | | 1 | 95 | 40-150 | 02/22/2024 1452 |
| PFNS | ND | 22 | 23 | | 1 | 103 | 40-150 | 02/22/2024 1452 |
| PFNA | 4.4 | 23 | 27 | | 1 | 100 | 40-150 | 02/22/2024 1452 |
| PFOSA | 1.3 | 23 | 22 | | 1 | 89 | 40-150 | 02/22/2024 1452 |
| PFOS | 940 | 21 | 1000 | NM-03 | 1 | 261 | 40-150 | 02/22/2024 1452 |
| PFOA | 29 | 23 | 53 | M-03 | 1 | 105 | 40-150 | 02/22/2024 1452 |
| PFPeS | 9.7 | 21 | 33 | | 1 | 108 | 40-150 | 02/22/2024 1452 |
| PFPeA | 10 | 45 | 53 | | 1 | 95 | 40-150 | 02/22/2024 1452 |
| 3:3FTCA | ND | 110 | 130 | M-03 | 1 | 113 | 40-150 | 02/22/2024 1452 |
| PFTeDA | ND | 23 | 24 | M-03 | 1 | 106 | 40-150 | 02/22/2024 1452 |
| PFTrDA | ND | 23 | 15 | M-03 | 1 | 68 | 40-150 | 02/22/2024 1452 |
| PFUnA | ND | 23 | 23 | | 1 | 102 | 40-150 | 02/22/2024 1452 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 |
| 13C2-6:2FTS | | 83 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZA29006-028MS
Batch: 96443
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/14/2024 1520

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 80 | 20-150 |
| 13C2-PFDoA | | 66 | 20-150 |
| 13C2-PFTeDA | | 28 | 20-150 |
| 13C3-HFPO-DA | | 94 | 20-150 |
| 13C3-PFBS | | 93 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 |
| 13C5-PFPeA | | 91 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 |
| 13C7-PFUnA | | 74 | 20-150 |
| 13C8-PFOA | | 84 | 20-150 |
| 13C8-PFOS | | 85 | 20-150 |
| 13C8-PFOSA | | 91 | 20-150 |
| 13C9-PFNA | | 83 | 20-150 |
| D3-NMeFOSA | | 72 | 20-150 |
| D3-NMeFOSAA | | 87 | 20-150 |
| D5-NEtFOSA | | 67 | 20-150 |
| D5-NEtFOSAA | | 82 | 20-150 |
| D7-NMeFOSE | | 57 | 20-150 |
| D9-NEtFOSE | | 31 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: ZA29006-028MD
Batch: 96443
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/14/2024 1520

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 88 | 70 | | 1 | 80 | 1.7 | 40-150 | 30 | 02/22/2024 1501 |
| 9Cl-PF3ONS | ND | 87 | 96 | | 1 | 110 | 4.2 | 40-150 | 30 | 02/22/2024 1501 |
| ADONA | ND | 88 | 110 | | 1 | 121 | 8.0 | 40-150 | 30 | 02/22/2024 1501 |
| 8:2FTS | 9.7 | 89 | 110 | | 1 | 108 | 16 | 40-150 | 30 | 02/22/2024 1501 |
| 4:2FTS | ND | 87 | 94 | | 1 | 108 | 7.3 | 40-150 | 30 | 02/22/2024 1501 |
| 6:2FTS | 4.3 | 89 | 97 | | 1 | 104 | 5.1 | 40-150 | 30 | 02/22/2024 1501 |
| 5:3FTCA | ND | 580 | 690 | | 1 | 118 | 3.0 | 40-150 | 30 | 02/22/2024 1501 |
| HFPO-DA | ND | 93 | 110 | | 1 | 116 | 9.6 | 40-150 | 30 | 02/22/2024 1501 |
| NEtFOSA | ND | 23 | 22 | | 1 | 94 | 4.1 | 40-150 | 30 | 02/22/2024 1501 |
| NEtFOSAA | ND | 23 | 23 | M-03 | 1 | 97 | 1.6 | 40-150 | 30 | 02/22/2024 1501 |
| NEtFOSE | ND | 230 | 180 | | 1 | 78 | 3.9 | 40-150 | 30 | 02/22/2024 1501 |
| NMeFOSA | ND | 23 | 24 | | 1 | 103 | 11 | 40-150 | 30 | 02/22/2024 1501 |
| NMeFOSAA | ND | 23 | 24 | M-03 | 1 | 103 | 1.5 | 40-150 | 30 | 02/22/2024 1501 |
| NMeFOSE | ND | 230 | 210 | | 1 | 88 | 2.0 | 40-150 | 30 | 02/22/2024 1501 |
| NFDHA | ND | 47 | 48 | | 1 | 103 | 6.2 | 40-150 | 30 | 02/22/2024 1501 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 41 | 44 | | 1 | 105 | 11 | 40-150 | 30 | 02/22/2024 1501 |
| PFMPA | ND | 47 | 52 | | 1 | 112 | 13 | 40-150 | 30 | 02/22/2024 1501 |
| PFMBA | ND | 47 | 48 | | 1 | 102 | 10 | 40-150 | 30 | 02/22/2024 1501 |
| PFBS | 5.3 | 21 | 26 | | 1 | 100 | 4.5 | 40-150 | 30 | 02/22/2024 1501 |
| PFBA | 8.1 | 93 | 98 | | 1 | 97 | 3.7 | 40-150 | 30 | 02/22/2024 1501 |
| PFDS | ND | 22 | 18 | | 1 | 82 | 2.2 | 40-150 | 30 | 02/22/2024 1501 |
| PFDA | ND | 23 | 23 | | 1 | 98 | 0.41 | 40-150 | 30 | 02/22/2024 1501 |
| PFDoS | ND | 23 | 7.9 | N | 1 | 35 | 16 | 40-150 | 30 | 02/22/2024 1501 |
| PFDoA | ND | 23 | 23 | | 1 | 100 | 8.7 | 40-150 | 30 | 02/22/2024 1501 |
| PFHpS | 14 | 22 | 43 | M-03 | 1 | 129 | 7.3 | 40-150 | 30 | 02/22/2024 1501 |
| PFHpA | 11 | 23 | 31 | | 1 | 88 | 5.8 | 40-150 | 30 | 02/22/2024 1501 |
| 7:3FTCA | ND | 580 | 610 | | 1 | 104 | 0.82 | 40-150 | 30 | 02/22/2024 1501 |
| PFHxS | 200 | 21 | 210 | M-03 | 1 | 46 | 5.7 | 40-150 | 30 | 02/22/2024 1501 |
| PFHxA | 14 | 23 | 36 | | 1 | 95 | 1.9 | 40-150 | 30 | 02/22/2024 1501 |
| PFNS | ND | 22 | 21 | | 1 | 95 | 5.4 | 40-150 | 30 | 02/22/2024 1501 |
| PFNA | 4.4 | 23 | 29 | | 1 | 106 | 6.8 | 40-150 | 30 | 02/22/2024 1501 |
| PFOSA | 1.3 | 23 | 26 | M-03 | 1 | 105 | 17 | 40-150 | 30 | 02/22/2024 1501 |
| PFOS | 940 | 22 | 960 | EM-03 | 1 | 94 | 3.5 | 40-150 | 30 | 02/22/2024 1501 |
| PFOA | 29 | 23 | 56 | M-03 | 1 | 115 | 5.5 | 40-150 | 30 | 02/22/2024 1501 |
| PFPeS | 9.7 | 22 | 32 | | 1 | 103 | 1.7 | 40-150 | 30 | 02/22/2024 1501 |
| PFPeA | 10 | 47 | 58 | | 1 | 102 | 8.2 | 40-150 | 30 | 02/22/2024 1501 |
| 3:3FTCA | ND | 120 | 140 | | 1 | 120 | 8.6 | 40-150 | 30 | 02/22/2024 1501 |
| PFTeDA | ND | 23 | 24 | | 1 | 102 | 0.73 | 40-150 | 30 | 02/22/2024 1501 |
| PFTrDA | ND | 23 | 15 | M-03 | 1 | 66 | 0.26 | 40-150 | 30 | 02/22/2024 1501 |
| PFUnA | ND | 23 | 25 | | 1 | 106 | 6.9 | 40-150 | 30 | 02/22/2024 1501 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 80 | 20-150 |
| 13C2-6:2FTS | | 80 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MSD

Sample ID: ZA29006-028MD
Batch: 96443
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/14/2024 1520

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 69 | 20-150 |
| 13C2-PFDoA | | 50 | 20-150 |
| 13C2-PFTeDA | | 23 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 |
| 13C3-PFBS | | 88 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 |
| 13C4-PFBA | | 82 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 |
| 13C5-PFHxA | | 84 | 20-150 |
| 13C5-PFPeA | | 81 | 20-150 |
| 13C6-PFDA | | 74 | 20-150 |
| 13C7-PFUnA | | 61 | 20-150 |
| 13C8-PFOA | | 78 | 20-150 |
| 13C8-PFOS | | 77 | 20-150 |
| 13C8-PFOSA | | 79 | 20-150 |
| 13C9-PFNA | | 73 | 20-150 |
| D3-NMeFOSA | | 60 | 20-150 |
| D3-NMeFOSAA | | 69 | 20-150 |
| D5-NEtFOSA | | 52 | 20-150 |
| D5-NEtFOSAA | | 59 | 20-150 |
| D7-NMeFOSE | | 33 | 20-150 |
| D9-NEtFOSE | N | 11 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96699-001
Batch: 96699
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1132

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 02/22/2024 0912 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 02/22/2024 0912 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 02/22/2024 0912 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 02/22/2024 0912 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 02/22/2024 0912 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 02/22/2024 0912 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 02/22/2024 0912 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 02/22/2024 0912 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 02/22/2024 0912 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/22/2024 0912 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 02/22/2024 0912 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 02/22/2024 0912 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/22/2024 0912 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 02/22/2024 0912 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 02/22/2024 0912 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 02/22/2024 0912 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 02/22/2024 0912 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 02/22/2024 0912 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 02/22/2024 0912 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 02/22/2024 0912 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 02/22/2024 0912 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/22/2024 0912 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 02/22/2024 0912 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 02/22/2024 0912 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 02/22/2024 0912 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/22/2024 0912 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 02/22/2024 0912 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 02/22/2024 0912 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/22/2024 0912 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 02/22/2024 0912 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 02/22/2024 0912 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 02/22/2024 0912 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 02/22/2024 0912 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/22/2024 0912 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 02/22/2024 0912 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 02/22/2024 0912 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 02/22/2024 0912 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 02/22/2024 0912 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 02/22/2024 0912 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 02/22/2024 0912 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 72 | 20-150 |
| 13C2-6:2FTS | | 74 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96699-001
Batch: 96699
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1132

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 66 | 20-150 |
| 13C2-PFDoA | | 85 | 20-150 |
| 13C2-PFTeDA | | 99 | 20-150 |
| 13C3-HFPO-DA | | 86 | 20-150 |
| 13C3-PFBS | | 79 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 |
| 13C4-PFBA | | 82 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 |
| 13C5-PFHxA | | 82 | 20-150 |
| 13C5-PFPeA | | 80 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 |
| 13C7-PFUnA | | 79 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 |
| 13C8-PFOS | | 69 | 20-150 |
| 13C8-PFOSA | | 84 | 20-150 |
| 13C9-PFNA | | 80 | 20-150 |
| D3-NMeFOSA | | 59 | 20-150 |
| D3-NMeFOSAA | | 78 | 20-150 |
| D5-NEtFOSA | | 59 | 20-150 |
| D5-NEtFOSAA | | 79 | 20-150 |
| D7-NMeFOSE | | 81 | 20-150 |
| D9-NEtFOSE | | 75 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96699-002
Batch: 96699
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1132

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 93 | | 1 | 103 | 40-150 | 02/22/2024 0922 |
| 9Cl-PF3ONS | 90 | 100 | | 1 | 113 | 40-150 | 02/22/2024 0922 |
| ADONA | 91 | 98 | | 1 | 108 | 40-150 | 02/22/2024 0922 |
| 8:2FTS | 92 | 120 | | 1 | 126 | 40-150 | 02/22/2024 0922 |
| 4:2FTS | 90 | 110 | | 1 | 119 | 40-150 | 02/22/2024 0922 |
| 6:2FTS | 91 | 97 | | 1 | 106 | 40-150 | 02/22/2024 0922 |
| 5:3FTCA | 600 | 680 | | 1 | 113 | 40-150 | 02/22/2024 0922 |
| HFPO-DA | 96 | 99 | | 1 | 103 | 40-150 | 02/22/2024 0922 |
| NEtFOSA | 24 | 26 | | 1 | 110 | 40-150 | 02/22/2024 0922 |
| NEtFOSAA | 24 | 28 | M-03 | 1 | 115 | 40-150 | 02/22/2024 0922 |
| NEtFOSE | 240 | 280 | | 1 | 118 | 40-150 | 02/22/2024 0922 |
| NMeFOSA | 24 | 28 | | 1 | 116 | 40-150 | 02/22/2024 0922 |
| NMeFOSAA | 24 | 28 | M-03 | 1 | 117 | 40-150 | 02/22/2024 0922 |
| NMeFOSE | 240 | 280 | | 1 | 116 | 40-150 | 02/22/2024 0922 |
| NFDHA | 48 | 54 | | 1 | 113 | 40-150 | 02/22/2024 0922 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 49 | | 1 | 115 | 40-150 | 02/22/2024 0922 |
| PFMPA | 48 | 56 | | 1 | 116 | 40-150 | 02/22/2024 0922 |
| PFMBA | 48 | 53 | | 1 | 111 | 40-150 | 02/22/2024 0922 |
| PFBS | 21 | 25 | | 1 | 116 | 40-150 | 02/22/2024 0922 |
| PFBA | 96 | 110 | | 1 | 114 | 40-150 | 02/22/2024 0922 |
| PFDS | 23 | 28 | | 1 | 121 | 40-150 | 02/22/2024 0922 |
| PFDA | 24 | 29 | | 1 | 119 | 40-150 | 02/22/2024 0922 |
| PFDoS | 23 | 23 | | 1 | 100 | 40-150 | 02/22/2024 0922 |
| PFDoA | 24 | 28 | | 1 | 116 | 40-150 | 02/22/2024 0922 |
| PFHpS | 23 | 27 | | 1 | 119 | 40-150 | 02/22/2024 0922 |
| PFHpA | 24 | 26 | | 1 | 109 | 40-150 | 02/22/2024 0922 |
| 7:3FTCA | 600 | 640 | | 1 | 107 | 40-150 | 02/22/2024 0922 |
| PFHxS | 22 | 26 | M-03 | 1 | 118 | 40-150 | 02/22/2024 0922 |
| PFHxA | 24 | 28 | | 1 | 116 | 40-150 | 02/22/2024 0922 |
| PFNS | 23 | 30 | | 1 | 128 | 40-150 | 02/22/2024 0922 |
| PFNA | 24 | 28 | | 1 | 118 | 40-150 | 02/22/2024 0922 |
| PFOSA | 24 | 27 | | 1 | 113 | 40-150 | 02/22/2024 0922 |
| PFOS | 22 | 29 | M-03 | 1 | 128 | 40-150 | 02/22/2024 0922 |
| PFOA | 24 | 25 | | 1 | 102 | 40-150 | 02/22/2024 0922 |
| PFPeS | 23 | 26 | | 1 | 116 | 40-150 | 02/22/2024 0922 |
| PFPeA | 48 | 55 | | 1 | 114 | 40-150 | 02/22/2024 0922 |
| 3:3FTCA | 120 | 130 | | 1 | 107 | 40-150 | 02/22/2024 0922 |
| PFTeDA | 24 | 29 | | 1 | 123 | 40-150 | 02/22/2024 0922 |
| PFTrDA | 24 | 26 | | 1 | 110 | 40-150 | 02/22/2024 0922 |
| PFUnA | 24 | 26 | | 1 | 110 | 40-150 | 02/22/2024 0922 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 73 | 20-150 |
| 13C2-6:2FTS | M-03 | 78 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96699-002
Batch: 96699
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1132

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 71 | 20-150 |
| 13C2-PFDoA | | 70 | 20-150 |
| 13C2-PFTeDA | | 64 | 20-150 |
| 13C3-HFPO-DA | | 80 | 20-150 |
| 13C3-PFBS | | 84 | 20-150 |
| 13C3-PFHxS | | 81 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 |
| 13C4-PFHpA | | 80 | 20-150 |
| 13C5-PFHxA | | 78 | 20-150 |
| 13C5-PFPeA | | 80 | 20-150 |
| 13C6-PFDA | | 74 | 20-150 |
| 13C7-PFUnA | | 71 | 20-150 |
| 13C8-PFOA | | 80 | 20-150 |
| 13C8-PFOS | | 70 | 20-150 |
| 13C8-PFOSA | | 69 | 20-150 |
| 13C9-PFNA | | 77 | 20-150 |
| D3-NMeFOSA | | 48 | 20-150 |
| D3-NMeFOSAA | | 74 | 20-150 |
| D5-NEtFOSA | | 51 | 20-150 |
| D5-NEtFOSAA | | 70 | 20-150 |
| D7-NMeFOSE | | 67 | 20-150 |
| D9-NEtFOSE | | 68 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96699-102
Batch: 96699
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1132

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.1 | | 1 | 95 | 40-150 | 02/22/2024 0931 |
| 9Cl-PF3ONS | 7.5 | 7.4 | | 1 | 99 | 40-150 | 02/22/2024 0931 |
| ADONA | 7.6 | 8.1 | | 1 | 108 | 40-150 | 02/22/2024 0931 |
| 8:2FTS | 7.7 | 9.3 | M-03 | 1 | 121 | 40-150 | 02/22/2024 0931 |
| 4:2FTS | 7.5 | 7.8 | | 1 | 104 | 40-150 | 02/22/2024 0931 |
| 6:2FTS | 7.6 | 9.3 | | 1 | 123 | 40-150 | 02/22/2024 0931 |
| 5:3FTCA | 50 | 53 | | 1 | 107 | 40-150 | 02/22/2024 0931 |
| HFPO-DA | 8.0 | 7.7 | M-03 | 1 | 97 | 40-150 | 02/22/2024 0931 |
| NEtFOSA | 2.0 | 2.1 | M-03 | 1 | 106 | 40-150 | 02/22/2024 0931 |
| NEtFOSAA | 2.0 | 1.7 | M-03 | 1 | 83 | 40-150 | 02/22/2024 0931 |
| NEtFOSE | 20 | 21 | | 1 | 104 | 40-150 | 02/22/2024 0931 |
| NMeFOSA | 2.0 | 2.1 | | 1 | 104 | 40-150 | 02/22/2024 0931 |
| NMeFOSAA | 2.0 | 1.6 | M-03 | 1 | 81 | 40-150 | 02/22/2024 0931 |
| NMeFOSE | 20 | 21 | | 1 | 106 | 40-150 | 02/22/2024 0931 |
| NFDHA | 4.0 | 4.4 | | 1 | 111 | 40-150 | 02/22/2024 0931 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.8 | | 1 | 108 | 40-150 | 02/22/2024 0931 |
| PFMPA | 4.0 | 4.7 | | 1 | 116 | 40-150 | 02/22/2024 0931 |
| PFMBA | 4.0 | 4.1 | | 1 | 103 | 40-150 | 02/22/2024 0931 |
| PFBS | 1.8 | 2.1 | M-03 | 1 | 116 | 40-150 | 02/22/2024 0931 |
| PFBA | 8.0 | 9.0 | | 1 | 113 | 40-150 | 02/22/2024 0931 |
| PFDS | 1.9 | 1.9 | M-03 | 1 | 99 | 40-150 | 02/22/2024 0931 |
| PFDA | 2.0 | 2.1 | M-03 | 1 | 105 | 40-150 | 02/22/2024 0931 |
| PFDoS | 1.9 | 1.9 | M-03 | 1 | 99 | 40-150 | 02/22/2024 0931 |
| PFDoA | 2.0 | 2.2 | | 1 | 110 | 40-150 | 02/22/2024 0931 |
| PFHpS | 1.9 | 2.0 | | 1 | 107 | 40-150 | 02/22/2024 0931 |
| PFHpA | 2.0 | 2.0 | M-03 | 1 | 101 | 40-150 | 02/22/2024 0931 |
| 7:3FTCA | 50 | 42 | | 1 | 84 | 40-150 | 02/22/2024 0931 |
| PFHxS | 1.8 | 1.9 | M-03 | 1 | 102 | 40-150 | 02/22/2024 0931 |
| PFHxA | 2.0 | 2.2 | | 1 | 111 | 40-150 | 02/22/2024 0931 |
| PFNS | 1.9 | 2.3 | | 1 | 119 | 40-150 | 02/22/2024 0931 |
| PFNA | 2.0 | 2.4 | M-03 | 1 | 119 | 40-150 | 02/22/2024 0931 |
| PFOSA | 2.0 | 2.3 | | 1 | 117 | 40-150 | 02/22/2024 0931 |
| PFOS | 1.9 | 2.3 | M-03 | 1 | 126 | 40-150 | 02/22/2024 0931 |
| PFOA | 2.0 | 2.3 | M-03 | 1 | 116 | 40-150 | 02/22/2024 0931 |
| PFPeS | 1.9 | 2.2 | M-03 | 1 | 117 | 40-150 | 02/22/2024 0931 |
| PFPeA | 4.0 | 4.3 | | 1 | 108 | 40-150 | 02/22/2024 0931 |
| 3:3FTCA | 10 | 11 | | 1 | 112 | 40-150 | 02/22/2024 0931 |
| PFTeDA | 2.0 | 2.3 | | 1 | 113 | 40-150 | 02/22/2024 0931 |
| PFTrDA | 2.0 | 2.2 | M-03 | 1 | 108 | 40-150 | 02/22/2024 0931 |
| PFUnA | 2.0 | 2.2 | | 1 | 110 | 40-150 | 02/22/2024 0931 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 136 | 20-150 |
| 13C2-6:2FTS | | 134 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96699-102
Batch: 96699
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1132

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 118 | 20-150 |
| 13C2-PFDoA | | 117 | 20-150 |
| 13C2-PFTeDA | | 117 | 20-150 |
| 13C3-HFPO-DA | N | 152 | 20-150 |
| 13C3-PFBS | | 144 | 20-150 |
| 13C3-PFHxS | | 144 | 20-150 |
| 13C4-PFBA | | 141 | 20-150 |
| 13C4-PFHpA | | 145 | 20-150 |
| 13C5-PFHxA | | 143 | 20-150 |
| 13C5-PFPeA | | 145 | 20-150 |
| 13C6-PFDA | | 127 | 20-150 |
| 13C7-PFUnA | | 119 | 20-150 |
| 13C8-PFOA | | 148 | 20-150 |
| 13C8-PFOS | | 138 | 20-150 |
| 13C8-PFOSA | | 125 | 20-150 |
| 13C9-PFNA | | 140 | 20-150 |
| D3-NMeFOSA | | 96 | 20-150 |
| D3-NMeFOSAA | | 146 | 20-150 |
| D5-NEtFOSA | | 98 | 20-150 |
| D5-NEtFOSAA | | 125 | 20-150 |
| D7-NMeFOSE | | 118 | 20-150 |
| D9-NEtFOSE | | 121 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96753-001
Batch: 96753
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1630

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 02/24/2024 1245 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 02/24/2024 1245 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 02/24/2024 1245 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 02/24/2024 1245 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 02/24/2024 1245 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 02/24/2024 1245 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 02/24/2024 1245 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 02/24/2024 1245 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 02/24/2024 1245 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/24/2024 1245 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 02/24/2024 1245 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 02/24/2024 1245 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/24/2024 1245 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 02/24/2024 1245 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 02/24/2024 1245 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 02/24/2024 1245 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 02/24/2024 1245 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 02/24/2024 1245 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 02/24/2024 1245 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 02/24/2024 1245 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 02/24/2024 1245 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/24/2024 1245 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 02/24/2024 1245 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 02/24/2024 1245 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 02/24/2024 1245 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/24/2024 1245 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 02/24/2024 1245 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 02/24/2024 1245 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/24/2024 1245 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 02/24/2024 1245 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 02/24/2024 1245 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 02/24/2024 1245 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 02/24/2024 1245 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/24/2024 1245 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 02/24/2024 1245 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 02/24/2024 1245 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 02/24/2024 1245 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 02/24/2024 1245 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 02/24/2024 1245 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 02/24/2024 1245 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96753-001
Batch: 96753
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1630

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 80 | 20-150 |
| 13C2-PFDoA | | 81 | 20-150 |
| 13C2-PFTeDA | | 81 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 |
| 13C3-PFBS | | 86 | 20-150 |
| 13C3-PFHxS | | 86 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 |
| 13C5-PFHxA | | 85 | 20-150 |
| 13C5-PFPeA | | 88 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 |
| 13C7-PFUnA | | 75 | 20-150 |
| 13C8-PFOA | | 78 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 |
| 13C8-PFOSA | | 81 | 20-150 |
| 13C9-PFNA | | 82 | 20-150 |
| D3-NMeFOSA | | 66 | 20-150 |
| D3-NMeFOSAA | | 85 | 20-150 |
| D5-NEtFOSA | | 70 | 20-150 |
| D5-NEtFOSAA | | 78 | 20-150 |
| D7-NMeFOSE | | 85 | 20-150 |
| D9-NEtFOSE | | 85 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96753-002
Batch: 96753
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1630

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 92 | | 1 | 102 | 40-150 | 02/24/2024 1254 |
| 9Cl-PF3ONS | 90 | 100 | | 1 | 111 | 40-150 | 02/24/2024 1254 |
| ADONA | 91 | 100 | | 1 | 112 | 40-150 | 02/24/2024 1254 |
| 8:2FTS | 92 | 110 | | 1 | 119 | 40-150 | 02/24/2024 1254 |
| 4:2FTS | 90 | 100 | | 1 | 114 | 40-150 | 02/24/2024 1254 |
| 6:2FTS | 91 | 100 | | 1 | 114 | 40-150 | 02/24/2024 1254 |
| 5:3FTCA | 600 | 650 | | 1 | 108 | 40-150 | 02/24/2024 1254 |
| HFPO-DA | 96 | 110 | | 1 | 110 | 40-150 | 02/24/2024 1254 |
| NEtFOSA | 24 | 25 | | 1 | 106 | 40-150 | 02/24/2024 1254 |
| NEtFOSAA | 24 | 25 | | 1 | 105 | 40-150 | 02/24/2024 1254 |
| NEtFOSE | 240 | 260 | | 1 | 109 | 40-150 | 02/24/2024 1254 |
| NMeFOSA | 24 | 26 | | 1 | 107 | 40-150 | 02/24/2024 1254 |
| NMeFOSAA | 24 | 29 | | 1 | 121 | 40-150 | 02/24/2024 1254 |
| NMeFOSE | 240 | 250 | | 1 | 106 | 40-150 | 02/24/2024 1254 |
| NFDHA | 48 | 50 | | 1 | 104 | 40-150 | 02/24/2024 1254 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 46 | | 1 | 108 | 40-150 | 02/24/2024 1254 |
| PFMPA | 48 | 53 | | 1 | 110 | 40-150 | 02/24/2024 1254 |
| PFMBA | 48 | 48 | | 1 | 101 | 40-150 | 02/24/2024 1254 |
| PFBS | 21 | 25 | | 1 | 115 | 40-150 | 02/24/2024 1254 |
| PFBA | 96 | 110 | | 1 | 111 | 40-150 | 02/24/2024 1254 |
| PFDS | 23 | 25 | | 1 | 108 | 40-150 | 02/24/2024 1254 |
| PFDA | 24 | 26 | | 1 | 110 | 40-150 | 02/24/2024 1254 |
| PFDoS | 23 | 22 | | 1 | 94 | 40-150 | 02/24/2024 1254 |
| PFDoA | 24 | 25 | | 1 | 102 | 40-150 | 02/24/2024 1254 |
| PFHpS | 23 | 26 | | 1 | 112 | 40-150 | 02/24/2024 1254 |
| PFHpA | 24 | 25 | | 1 | 106 | 40-150 | 02/24/2024 1254 |
| 7:3FTCA | 600 | 600 | | 1 | 100 | 40-150 | 02/24/2024 1254 |
| PFHxS | 22 | 24 | | 1 | 107 | 40-150 | 02/24/2024 1254 |
| PFHxA | 24 | 27 | | 1 | 112 | 40-150 | 02/24/2024 1254 |
| PFNS | 23 | 26 | | 1 | 111 | 40-150 | 02/24/2024 1254 |
| PFNA | 24 | 25 | | 1 | 103 | 40-150 | 02/24/2024 1254 |
| PFOSA | 24 | 26 | | 1 | 109 | 40-150 | 02/24/2024 1254 |
| PFOS | 22 | 25 | M-03 | 1 | 112 | 40-150 | 02/24/2024 1254 |
| PFOA | 24 | 27 | | 1 | 113 | 40-150 | 02/24/2024 1254 |
| PFPeS | 23 | 23 | | 1 | 103 | 40-150 | 02/24/2024 1254 |
| PFPeA | 48 | 53 | | 1 | 111 | 40-150 | 02/24/2024 1254 |
| 3:3FTCA | 120 | 140 | | 1 | 118 | 40-150 | 02/24/2024 1254 |
| PFTeDA | 24 | 27 | | 1 | 113 | 40-150 | 02/24/2024 1254 |
| PFTrDA | 24 | 25 | | 1 | 105 | 40-150 | 02/24/2024 1254 |
| PFUnA | 24 | 27 | | 1 | 112 | 40-150 | 02/24/2024 1254 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 77 | 20-150 |
| 13C2-6:2FTS | | 75 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96753-002
Batch: 96753
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1630

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 75 | 20-150 |
| 13C2-PFDoA | | 72 | 20-150 |
| 13C2-PFTeDA | | 65 | 20-150 |
| 13C3-HFPO-DA | | 79 | 20-150 |
| 13C3-PFBS | | 79 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 |
| 13C5-PFPeA | | 83 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 |
| 13C7-PFUnA | | 76 | 20-150 |
| 13C8-PFOA | | 77 | 20-150 |
| 13C8-PFOS | | 74 | 20-150 |
| 13C8-PFOSA | | 74 | 20-150 |
| 13C9-PFNA | | 79 | 20-150 |
| D3-NMeFOSA | | 63 | 20-150 |
| D3-NMeFOSAA | | 74 | 20-150 |
| D5-NEtFOSA | | 65 | 20-150 |
| D5-NEtFOSAA | | 78 | 20-150 |
| D7-NMeFOSE | | 74 | 20-150 |
| D9-NEtFOSE | | 71 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96753-102
Batch: 96753
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1630

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 8.2 | | 1 | 108 | 40-150 | 02/24/2024 1304 |
| 9Cl-PF3ONS | 7.5 | 8.8 | | 1 | 117 | 40-150 | 02/24/2024 1304 |
| ADONA | 7.6 | 9.9 | | 1 | 131 | 40-150 | 02/24/2024 1304 |
| 8:2FTS | 7.7 | 8.7 | | 1 | 113 | 40-150 | 02/24/2024 1304 |
| 4:2FTS | 7.5 | 7.5 | | 1 | 100 | 40-150 | 02/24/2024 1304 |
| 6:2FTS | 7.6 | 9.8 | | 1 | 129 | 40-150 | 02/24/2024 1304 |
| 5:3FTCA | 50 | 55 | | 1 | 111 | 40-150 | 02/24/2024 1304 |
| HFPO-DA | 8.0 | 8.5 | | 1 | 107 | 40-150 | 02/24/2024 1304 |
| NEtFOSA | 2.0 | 2.2 | | 1 | 109 | 40-150 | 02/24/2024 1304 |
| NEtFOSAA | 2.0 | 2.5 | M-03 | 1 | 125 | 40-150 | 02/24/2024 1304 |
| NEtFOSE | 20 | 23 | | 1 | 113 | 40-150 | 02/24/2024 1304 |
| NMeFOSA | 2.0 | 2.3 | | 1 | 113 | 40-150 | 02/24/2024 1304 |
| NMeFOSAA | 2.0 | 2.2 | | 1 | 109 | 40-150 | 02/24/2024 1304 |
| NMeFOSE | 20 | 23 | | 1 | 116 | 40-150 | 02/24/2024 1304 |
| NFDHA | 4.0 | 4.4 | | 1 | 109 | 40-150 | 02/24/2024 1304 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.1 | | 1 | 115 | 40-150 | 02/24/2024 1304 |
| PFMPA | 4.0 | 4.8 | | 1 | 121 | 40-150 | 02/24/2024 1304 |
| PFMBA | 4.0 | 4.1 | | 1 | 102 | 40-150 | 02/24/2024 1304 |
| PFBS | 1.8 | 2.1 | | 1 | 116 | 40-150 | 02/24/2024 1304 |
| PFBA | 8.0 | 9.3 | | 1 | 116 | 40-150 | 02/24/2024 1304 |
| PFDS | 1.9 | 2.6 | M-03 | 1 | 134 | 40-150 | 02/24/2024 1304 |
| PFDA | 2.0 | 2.5 | | 1 | 124 | 40-150 | 02/24/2024 1304 |
| PFDoS | 1.9 | 2.2 | | 1 | 112 | 40-150 | 02/24/2024 1304 |
| PFDoA | 2.0 | 2.2 | | 1 | 112 | 40-150 | 02/24/2024 1304 |
| PFHpS | 1.9 | 2.3 | | 1 | 124 | 40-150 | 02/24/2024 1304 |
| PFHpA | 2.0 | 2.3 | | 1 | 115 | 40-150 | 02/24/2024 1304 |
| 7:3FTCA | 50 | 56 | | 1 | 111 | 40-150 | 02/24/2024 1304 |
| PFHxS | 1.8 | 2.1 | M-03 | 1 | 114 | 40-150 | 02/24/2024 1304 |
| PFHxA | 2.0 | 2.3 | | 1 | 116 | 40-150 | 02/24/2024 1304 |
| PFNS | 1.9 | 2.4 | | 1 | 123 | 40-150 | 02/24/2024 1304 |
| PFNA | 2.0 | 2.3 | | 1 | 116 | 40-150 | 02/24/2024 1304 |
| PFOSA | 2.0 | 2.4 | | 1 | 122 | 40-150 | 02/24/2024 1304 |
| PFOS | 1.9 | 2.4 | M-03 | 1 | 127 | 40-150 | 02/24/2024 1304 |
| PFOA | 2.0 | 2.2 | M-03 | 1 | 109 | 40-150 | 02/24/2024 1304 |
| PFPeS | 1.9 | 2.1 | | 1 | 109 | 40-150 | 02/24/2024 1304 |
| PFPeA | 4.0 | 4.7 | | 1 | 118 | 40-150 | 02/24/2024 1304 |
| 3:3FTCA | 10 | 12 | | 1 | 120 | 40-150 | 02/24/2024 1304 |
| PFTeDA | 2.0 | 2.3 | | 1 | 116 | 40-150 | 02/24/2024 1304 |
| PFTrDA | 2.0 | 2.0 | | 1 | 98 | 40-150 | 02/24/2024 1304 |
| PFUnA | 2.0 | 2.3 | | 1 | 114 | 40-150 | 02/24/2024 1304 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 78 | 20-150 |
| 13C2-6:2FTS | | 71 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96753-102
Batch: 96753
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/19/2024 1630

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 72 | 20-150 |
| 13C2-PFDoA | | 76 | 20-150 |
| 13C2-PFTeDA | | 74 | 20-150 |
| 13C3-HFPO-DA | | 80 | 20-150 |
| 13C3-PFBS | | 78 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 |
| 13C4-PFHpA | | 80 | 20-150 |
| 13C5-PFHxA | | 83 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 |
| 13C6-PFDA | | 77 | 20-150 |
| 13C7-PFUnA | | 76 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 |
| 13C8-PFOS | | 75 | 20-150 |
| 13C8-PFOSA | | 78 | 20-150 |
| 13C9-PFNA | | 79 | 20-150 |
| D3-NMeFOSA | | 67 | 20-150 |
| D3-NMeFOSAA | | 79 | 20-150 |
| D5-NEtFOSA | | 71 | 20-150 |
| D5-NEtFOSAA | | 79 | 20-150 |
| D7-NMeFOSE | | 84 | 20-150 |
| D9-NEtFOSE | | 81 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96772-001
Batch: 96772
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/20/2024 1023

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 02/21/2024 2108 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 02/21/2024 2108 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 02/21/2024 2108 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 02/21/2024 2108 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 02/21/2024 2108 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 02/21/2024 2108 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 02/21/2024 2108 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 02/21/2024 2108 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 02/21/2024 2108 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/21/2024 2108 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 02/21/2024 2108 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 02/21/2024 2108 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/21/2024 2108 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 02/21/2024 2108 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 02/21/2024 2108 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 02/21/2024 2108 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 02/21/2024 2108 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 02/21/2024 2108 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 02/21/2024 2108 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 02/21/2024 2108 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 02/21/2024 2108 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/21/2024 2108 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 02/21/2024 2108 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 02/21/2024 2108 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 02/21/2024 2108 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/21/2024 2108 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 02/21/2024 2108 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 02/21/2024 2108 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/21/2024 2108 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 02/21/2024 2108 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 02/21/2024 2108 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 02/21/2024 2108 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 02/21/2024 2108 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/21/2024 2108 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 02/21/2024 2108 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 02/21/2024 2108 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 02/21/2024 2108 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 02/21/2024 2108 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 02/21/2024 2108 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 02/21/2024 2108 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 100 | 20-150 |
| 13C2-6:2FTS | | 88 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96772-001
Batch: 96772
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/20/2024 1023

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 81 | 20-150 |
| 13C2-PFDoA | | 69 | 20-150 |
| 13C2-PFTeDA | | 65 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 |
| 13C3-PFBS | | 79 | 20-150 |
| 13C3-PFHxS | | 92 | 20-150 |
| 13C4-PFBA | | 79 | 20-150 |
| 13C4-PFHpA | | 93 | 20-150 |
| 13C5-PFHxA | | 93 | 20-150 |
| 13C5-PFPeA | | 124 | 20-150 |
| 13C6-PFDA | | 86 | 20-150 |
| 13C7-PFUnA | | 76 | 20-150 |
| 13C8-PFOA | | 94 | 20-150 |
| 13C8-PFOS | | 74 | 20-150 |
| 13C8-PFOSA | | 72 | 20-150 |
| 13C9-PFNA | M-03 | 66 | 20-150 |
| D3-NMeFOSA | | 48 | 20-150 |
| D3-NMeFOSAA | M-03 | 80 | 20-150 |
| D5-NEtFOSA | | 52 | 20-150 |
| D5-NEtFOSAA | | 87 | 20-150 |
| D7-NMeFOSE | | 70 | 20-150 |
| D9-NEtFOSE | | 72 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96772-002
Batch: 96772
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/20/2024 1023

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 82 | | 1 | 90 | 40-150 | 02/21/2024 2124 |
| 9Cl-PF3ONS | 90 | 85 | M-03 | 1 | 94 | 40-150 | 02/21/2024 2124 |
| ADONA | 91 | 100 | | 1 | 112 | 40-150 | 02/21/2024 2124 |
| 8:2FTS | 92 | 140 | M-03 | 1 | 148 | 40-150 | 02/21/2024 2124 |
| 4:2FTS | 90 | 95 | | 1 | 105 | 40-150 | 02/21/2024 2124 |
| 6:2FTS | 91 | 120 | | 1 | 134 | 40-150 | 02/21/2024 2124 |
| 5:3FTCA | 600 | 670 | | 1 | 111 | 40-150 | 02/21/2024 2124 |
| HFPO-DA | 96 | 100 | | 1 | 107 | 40-150 | 02/21/2024 2124 |
| NEtFOSA | 24 | 29 | | 1 | 123 | 40-150 | 02/21/2024 2124 |
| NEtFOSAA | 24 | 26 | | 1 | 107 | 40-150 | 02/21/2024 2124 |
| NEtFOSE | 240 | 280 | | 1 | 118 | 40-150 | 02/21/2024 2124 |
| NMeFOSA | 24 | 28 | | 1 | 115 | 40-150 | 02/21/2024 2124 |
| NMeFOSAA | 24 | 25 | M-03 | 1 | 103 | 40-150 | 02/21/2024 2124 |
| NMeFOSE | 240 | 290 | | 1 | 119 | 40-150 | 02/21/2024 2124 |
| NFDHA | 48 | 50 | | 1 | 105 | 40-150 | 02/21/2024 2124 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 45 | | 1 | 105 | 40-150 | 02/21/2024 2124 |
| PFMPA | 48 | 40 | M-03 | 1 | 82 | 40-150 | 02/21/2024 2124 |
| PFMBA | 48 | 49 | | 1 | 101 | 40-150 | 02/21/2024 2124 |
| PFBS | 21 | 24 | | 1 | 112 | 40-150 | 02/21/2024 2124 |
| PFBA | 96 | 110 | | 1 | 115 | 40-150 | 02/21/2024 2124 |
| PFDS | 23 | 21 | M-03 | 1 | 90 | 40-150 | 02/21/2024 2124 |
| PFDA | 24 | 30 | | 1 | 127 | 40-150 | 02/21/2024 2124 |
| PFDoS | 23 | 21 | M-03 | 1 | 89 | 40-150 | 02/21/2024 2124 |
| PFDoA | 24 | 30 | | 1 | 125 | 40-150 | 02/21/2024 2124 |
| PFHpS | 23 | 28 | M-03 | 1 | 121 | 40-150 | 02/21/2024 2124 |
| PFHpA | 24 | 22 | | 1 | 93 | 40-150 | 02/21/2024 2124 |
| 7:3FTCA | 600 | 480 | | 1 | 81 | 40-150 | 02/21/2024 2124 |
| PFHxS | 22 | 26 | M-03 | 1 | 120 | 40-150 | 02/21/2024 2124 |
| PFHxA | 24 | 27 | | 1 | 114 | 40-150 | 02/21/2024 2124 |
| PFNS | 23 | 23 | M-03 | 1 | 101 | 40-150 | 02/21/2024 2124 |
| PFNA | 24 | 34 | | 1 | 143 | 40-150 | 02/21/2024 2124 |
| PFOSA | 24 | 29 | M-03 | 1 | 123 | 40-150 | 02/21/2024 2124 |
| PFOS | 22 | 22 | M-03 | 1 | 99 | 40-150 | 02/21/2024 2124 |
| PFOA | 24 | 20 | | 1 | 84 | 40-150 | 02/21/2024 2124 |
| PFPeS | 23 | 27 | | 1 | 120 | 40-150 | 02/21/2024 2124 |
| PFPeA | 48 | 56 | | 1 | 116 | 40-150 | 02/21/2024 2124 |
| 3:3FTCA | 120 | 99 | | 1 | 82 | 40-150 | 02/21/2024 2124 |
| PFTeDA | 24 | 28 | | 1 | 116 | 40-150 | 02/21/2024 2124 |
| PFTrDA | 24 | 31 | M-03 | 1 | 130 | 40-150 | 02/21/2024 2124 |
| PFUnA | 24 | 27 | | 1 | 111 | 40-150 | 02/21/2024 2124 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 |
| 13C2-6:2FTS | M-03 | 76 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96772-002
Batch: 96772
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/20/2024 1023

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | M-03 | 68 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 |
| 13C2-PFTeDA | | 68 | 20-150 |
| 13C3-HFPO-DA | | 102 | 20-150 |
| 13C3-PFBS | | 84 | 20-150 |
| 13C3-PFHxS | | 76 | 20-150 |
| 13C4-PFBA | M-03 | 87 | 20-150 |
| 13C4-PFHpA | | 113 | 20-150 |
| 13C5-PFHxA | | 107 | 20-150 |
| 13C5-PFPeA | | 135 | 20-150 |
| 13C6-PFDA | | 71 | 20-150 |
| 13C7-PFUnA | M-03 | 75 | 20-150 |
| 13C8-PFOA | | 111 | 20-150 |
| 13C8-PFOS | M-03 | 97 | 20-150 |
| 13C8-PFOSA | | 79 | 20-150 |
| 13C9-PFNA | M-03 | 59 | 20-150 |
| D3-NMeFOSA | | 59 | 20-150 |
| D3-NMeFOSAA | | 90 | 20-150 |
| D5-NEtFOSA | | 59 | 20-150 |
| D5-NEtFOSAA | M-03 | 90 | 20-150 |
| D7-NMeFOSE | | 80 | 20-150 |
| D9-NEtFOSE | | 81 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96772-102
Batch: 96772
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/20/2024 1023

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 5.9 | | 1 | 79 | 40-150 | 02/21/2024 2140 |
| 9Cl-PF3ONS | 7.5 | 6.4 | M-03 | 1 | 86 | 40-150 | 02/21/2024 2140 |
| ADONA | 7.6 | 6.6 | | 1 | 87 | 40-150 | 02/21/2024 2140 |
| 8:2FTS | 7.7 | 12 | NM-03 | 1 | 162 | 40-150 | 02/21/2024 2140 |
| 4:2FTS | 7.5 | 7.8 | | 1 | 103 | 40-150 | 02/21/2024 2140 |
| 6:2FTS | 7.6 | 8.0 | | 1 | 106 | 40-150 | 02/21/2024 2140 |
| 5:3FTCA | 50 | 63 | | 1 | 126 | 40-150 | 02/21/2024 2140 |
| HFPO-DA | 8.0 | 7.8 | | 1 | 98 | 40-150 | 02/21/2024 2140 |
| NEtFOSA | 2.0 | 2.3 | M-03 | 1 | 115 | 40-150 | 02/21/2024 2140 |
| NEtFOSAA | 2.0 | 2.0 | M-03 | 1 | 100 | 40-150 | 02/21/2024 2140 |
| NEtFOSE | 20 | 24 | | 1 | 119 | 40-150 | 02/21/2024 2140 |
| NMeFOSA | 2.0 | 2.6 | M-03 | 1 | 130 | 40-150 | 02/21/2024 2140 |
| NMeFOSAA | 2.0 | 1.8 | M-03 | 1 | 91 | 40-150 | 02/21/2024 2140 |
| NMeFOSE | 20 | 27 | | 1 | 133 | 40-150 | 02/21/2024 2140 |
| NFDHA | 4.0 | 4.2 | | 1 | 104 | 40-150 | 02/21/2024 2140 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.9 | | 1 | 110 | 40-150 | 02/21/2024 2140 |
| PFMPA | 4.0 | 3.4 | | 1 | 86 | 40-150 | 02/21/2024 2140 |
| PFMBA | 4.0 | 4.0 | | 1 | 101 | 40-150 | 02/21/2024 2140 |
| PFBS | 1.8 | 1.8 | | 1 | 103 | 40-150 | 02/21/2024 2140 |
| PFBA | 8.0 | 10 | | 1 | 130 | 40-150 | 02/21/2024 2140 |
| PFDS | 1.9 | 2.5 | M-03 | 1 | 127 | 40-150 | 02/21/2024 2140 |
| PFDA | 2.0 | 2.6 | M-03 | 1 | 129 | 40-150 | 02/21/2024 2140 |
| PFDoS | 1.9 | 2.2 | M-03 | 1 | 114 | 40-150 | 02/21/2024 2140 |
| PFDoA | 2.0 | 2.5 | | 1 | 127 | 40-150 | 02/21/2024 2140 |
| PFHpS | 1.9 | 2.4 | M-03 | 1 | 125 | 40-150 | 02/21/2024 2140 |
| PFHpA | 2.0 | 2.3 | | 1 | 116 | 40-150 | 02/21/2024 2140 |
| 7:3FTCA | 50 | 66 | | 1 | 132 | 40-150 | 02/21/2024 2140 |
| PFHxS | 1.8 | 2.7 | M-03 | 1 | 150 | 40-150 | 02/21/2024 2140 |
| PFHxA | 2.0 | 2.0 | | 1 | 98 | 40-150 | 02/21/2024 2140 |
| PFNS | 1.9 | 2.2 | M-03 | 1 | 114 | 40-150 | 02/21/2024 2140 |
| PFNA | 2.0 | 2.4 | M-03 | 1 | 121 | 40-150 | 02/21/2024 2140 |
| PFOSA | 2.0 | 2.6 | M-03 | 1 | 129 | 40-150 | 02/21/2024 2140 |
| PFOS | 1.9 | 2.2 | M-03 | 1 | 118 | 40-150 | 02/21/2024 2140 |
| PFOA | 2.0 | 2.6 | M-03 | 1 | 128 | 40-150 | 02/21/2024 2140 |
| PFPeS | 1.9 | 2.7 | | 1 | 146 | 40-150 | 02/21/2024 2140 |
| PFPeA | 4.0 | 4.5 | | 1 | 113 | 40-150 | 02/21/2024 2140 |
| 3:3FTCA | 10 | 6.9 | | 1 | 69 | 40-150 | 02/21/2024 2140 |
| PFTeDA | 2.0 | 2.3 | M-03 | 1 | 117 | 40-150 | 02/21/2024 2140 |
| PFTrDA | 2.0 | 2.3 | M-03 | 1 | 117 | 40-150 | 02/21/2024 2140 |
| PFUnA | 2.0 | 2.6 | M-03 | 1 | 128 | 40-150 | 02/21/2024 2140 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 103 | 20-150 |
| 13C2-6:2FTS | | 105 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96772-102
Batch: 96772
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/20/2024 1023

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | M-03 | 91 | 20-150 |
| 13C2-PFDoA | | 73 | 20-150 |
| 13C2-PFTeDA | | 69 | 20-150 |
| 13C3-HFPO-DA | | 98 | 20-150 |
| 13C3-PFBS | | 99 | 20-150 |
| 13C3-PFHxS | | 92 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 |
| 13C4-PFHpA | | 87 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 |
| 13C5-PFPeA | | 106 | 20-150 |
| 13C6-PFDA | | 83 | 20-150 |
| 13C7-PFUnA | M-03 | 76 | 20-150 |
| 13C8-PFOA | M-03 | 75 | 20-150 |
| 13C8-PFOS | | 77 | 20-150 |
| 13C8-PFOSA | | 76 | 20-150 |
| 13C9-PFNA | M-03 | 81 | 20-150 |
| D3-NMeFOSA | | 50 | 20-150 |
| D3-NMeFOSAA | | 85 | 20-150 |
| D5-NEtFOSA | | 51 | 20-150 |
| D5-NEtFOSAA | | 94 | 20-150 |
| D7-NMeFOSE | | 65 | 20-150 |
| D9-NEtFOSE | | 71 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96883-001
Batch: 96883
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/21/2024 1208

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 02/23/2024 0047 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 02/23/2024 0047 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 02/23/2024 0047 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 02/23/2024 0047 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 02/23/2024 0047 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 02/23/2024 0047 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 02/23/2024 0047 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 02/23/2024 0047 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 02/23/2024 0047 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/23/2024 0047 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 02/23/2024 0047 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 02/23/2024 0047 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/23/2024 0047 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 02/23/2024 0047 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 02/23/2024 0047 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 02/23/2024 0047 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 02/23/2024 0047 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 02/23/2024 0047 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 02/23/2024 0047 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 02/23/2024 0047 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 02/23/2024 0047 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/23/2024 0047 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 02/23/2024 0047 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 02/23/2024 0047 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 02/23/2024 0047 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/23/2024 0047 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 02/23/2024 0047 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 02/23/2024 0047 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/23/2024 0047 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 02/23/2024 0047 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 02/23/2024 0047 |
| PFOSA | 0.40 | UM-03 | 1 | 1.0 | 0.40 | 0.20 | ng/L | 02/23/2024 0047 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 02/23/2024 0047 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/23/2024 0047 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 02/23/2024 0047 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 02/23/2024 0047 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 02/23/2024 0047 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 02/23/2024 0047 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 02/23/2024 0047 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 02/23/2024 0047 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 76 | 20-150 |
| 13C2-6:2FTS | | 77 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MB

Sample ID: ZQ96883-001
Batch: 96883
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/21/2024 1208

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 65 | 20-150 |
| 13C2-PFDoA | | 71 | 20-150 |
| 13C2-PFTeDA | | 82 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 |
| 13C3-PFBS | | 81 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 |
| 13C5-PFHxA | | 79 | 20-150 |
| 13C5-PFPeA | | 78 | 20-150 |
| 13C6-PFDA | | 77 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 |
| 13C8-PFOA | | 80 | 20-150 |
| 13C8-PFOS | | 81 | 20-150 |
| 13C8-PFOSA | | 77 | 20-150 |
| 13C9-PFNA | | 77 | 20-150 |
| D3-NMeFOSA | | 65 | 20-150 |
| D3-NMeFOSAA | | 87 | 20-150 |
| D5-NEtFOSA | | 67 | 20-150 |
| D5-NEtFOSAA | | 82 | 20-150 |
| D7-NMeFOSE | | 78 | 20-150 |
| D9-NEtFOSE | | 77 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96883-002
Batch: 96883
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/21/2024 1208

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 80 | | 1 | 88 | 40-150 | 02/23/2024 0056 |
| 9Cl-PF3ONS | 90 | 84 | | 1 | 94 | 40-150 | 02/23/2024 0056 |
| ADONA | 91 | 89 | | 1 | 99 | 40-150 | 02/23/2024 0056 |
| 8:2FTS | 92 | 88 | | 1 | 95 | 40-150 | 02/23/2024 0056 |
| 4:2FTS | 90 | 86 | | 1 | 95 | 40-150 | 02/23/2024 0056 |
| 6:2FTS | 91 | 91 | | 1 | 100 | 40-150 | 02/23/2024 0056 |
| 5:3FTCA | 600 | 590 | | 1 | 98 | 40-150 | 02/23/2024 0056 |
| HFPO-DA | 96 | 89 | | 1 | 93 | 40-150 | 02/23/2024 0056 |
| NEtFOSA | 24 | 22 | | 1 | 91 | 40-150 | 02/23/2024 0056 |
| NEtFOSAA | 24 | 23 | M-03 | 1 | 97 | 40-150 | 02/23/2024 0056 |
| NEtFOSE | 240 | 230 | | 1 | 96 | 40-150 | 02/23/2024 0056 |
| NMeFOSA | 24 | 23 | | 1 | 95 | 40-150 | 02/23/2024 0056 |
| NMeFOSAA | 24 | 24 | M-03 | 1 | 101 | 40-150 | 02/23/2024 0056 |
| NMeFOSE | 240 | 230 | | 1 | 98 | 40-150 | 02/23/2024 0056 |
| NFDHA | 48 | 46 | | 1 | 96 | 40-150 | 02/23/2024 0056 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 40 | | 1 | 93 | 40-150 | 02/23/2024 0056 |
| PFMPA | 48 | 50 | | 1 | 105 | 40-150 | 02/23/2024 0056 |
| PFMBA | 48 | 45 | | 1 | 95 | 40-150 | 02/23/2024 0056 |
| PFBS | 21 | 20 | | 1 | 95 | 40-150 | 02/23/2024 0056 |
| PFBA | 96 | 91 | | 1 | 94 | 40-150 | 02/23/2024 0056 |
| PFDS | 23 | 21 | | 1 | 89 | 40-150 | 02/23/2024 0056 |
| PFDA | 24 | 22 | | 1 | 94 | 40-150 | 02/23/2024 0056 |
| PFDoS | 23 | 18 | | 1 | 79 | 40-150 | 02/23/2024 0056 |
| PFDoA | 24 | 24 | | 1 | 98 | 40-150 | 02/23/2024 0056 |
| PFHpS | 23 | 23 | | 1 | 99 | 40-150 | 02/23/2024 0056 |
| PFHpA | 24 | 22 | | 1 | 94 | 40-150 | 02/23/2024 0056 |
| 7:3FTCA | 600 | 530 | | 1 | 89 | 40-150 | 02/23/2024 0056 |
| PFHxS | 22 | 23 | M-03 | 1 | 105 | 40-150 | 02/23/2024 0056 |
| PFHxA | 24 | 23 | | 1 | 95 | 40-150 | 02/23/2024 0056 |
| PFNS | 23 | 21 | | 1 | 92 | 40-150 | 02/23/2024 0056 |
| PFNA | 24 | 23 | | 1 | 97 | 40-150 | 02/23/2024 0056 |
| PFOSA | 24 | 23 | | 1 | 95 | 40-150 | 02/23/2024 0056 |
| PFOS | 22 | 21 | M-03 | 1 | 95 | 40-150 | 02/23/2024 0056 |
| PFOA | 24 | 22 | | 1 | 90 | 40-150 | 02/23/2024 0056 |
| PFPeS | 23 | 23 | | 1 | 103 | 40-150 | 02/23/2024 0056 |
| PFPeA | 48 | 45 | | 1 | 94 | 40-150 | 02/23/2024 0056 |
| 3:3FTCA | 120 | 130 | | 1 | 108 | 40-150 | 02/23/2024 0056 |
| PFTeDA | 24 | 23 | | 1 | 96 | 40-150 | 02/23/2024 0056 |
| PFTrDA | 24 | 23 | | 1 | 96 | 40-150 | 02/23/2024 0056 |
| PFUnA | 24 | 23 | | 1 | 98 | 40-150 | 02/23/2024 0056 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 90 | 20-150 |
| 13C2-6:2FTS | | 84 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96883-002
Batch: 96883
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/21/2024 1208

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 82 | 20-150 |
| 13C2-PFDoA | | 76 | 20-150 |
| 13C2-PFTeDA | | 91 | 20-150 |
| 13C3-HFPO-DA | | 90 | 20-150 |
| 13C3-PFBS | | 89 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 |
| 13C5-PFPeA | | 86 | 20-150 |
| 13C6-PFDA | | 86 | 20-150 |
| 13C7-PFUnA | | 77 | 20-150 |
| 13C8-PFOA | | 83 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 |
| 13C8-PFOSA | | 82 | 20-150 |
| 13C9-PFNA | | 82 | 20-150 |
| D3-NMeFOSA | | 68 | 20-150 |
| D3-NMeFOSAA | | 81 | 20-150 |
| D5-NEtFOSA | | 71 | 20-150 |
| D5-NEtFOSAA | | 81 | 20-150 |
| D7-NMeFOSE | | 78 | 20-150 |
| D9-NEtFOSE | | 77 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96883-102
Batch: 96883
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/21/2024 1208

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.0 | | 1 | 92 | 40-150 | 02/23/2024 0105 |
| 9Cl-PF3ONS | 7.5 | 7.2 | | 1 | 97 | 40-150 | 02/23/2024 0105 |
| ADONA | 7.6 | 8.2 | | 1 | 108 | 40-150 | 02/23/2024 0105 |
| 8:2FTS | 7.7 | 9.5 | | 1 | 124 | 40-150 | 02/23/2024 0105 |
| 4:2FTS | 7.5 | 8.7 | | 1 | 116 | 40-150 | 02/23/2024 0105 |
| 6:2FTS | 7.6 | 8.6 | | 1 | 114 | 40-150 | 02/23/2024 0105 |
| 5:3FTCA | 50 | 53 | | 1 | 105 | 40-150 | 02/23/2024 0105 |
| HFPO-DA | 8.0 | 8.3 | | 1 | 104 | 40-150 | 02/23/2024 0105 |
| NEtFOSA | 2.0 | 2.1 | | 1 | 107 | 40-150 | 02/23/2024 0105 |
| NEtFOSAA | 2.0 | 2.0 | M-03 | 1 | 101 | 40-150 | 02/23/2024 0105 |
| NEtFOSE | 20 | 23 | | 1 | 114 | 40-150 | 02/23/2024 0105 |
| NMeFOSA | 2.0 | 2.3 | | 1 | 115 | 40-150 | 02/23/2024 0105 |
| NMeFOSAA | 2.0 | 2.2 | M-03 | 1 | 108 | 40-150 | 02/23/2024 0105 |
| NMeFOSE | 20 | 22 | | 1 | 112 | 40-150 | 02/23/2024 0105 |
| NFDHA | 4.0 | 4.7 | | 1 | 118 | 40-150 | 02/23/2024 0105 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.8 | | 1 | 108 | 40-150 | 02/23/2024 0105 |
| PFMPA | 4.0 | 4.7 | | 1 | 118 | 40-150 | 02/23/2024 0105 |
| PFMBA | 4.0 | 4.5 | | 1 | 112 | 40-150 | 02/23/2024 0105 |
| PFBS | 1.8 | 2.2 | M-03 | 1 | 125 | 40-150 | 02/23/2024 0105 |
| PFBA | 8.0 | 9.1 | | 1 | 113 | 40-150 | 02/23/2024 0105 |
| PFDS | 1.9 | 2.0 | | 1 | 104 | 40-150 | 02/23/2024 0105 |
| PFDA | 2.0 | 2.1 | | 1 | 104 | 40-150 | 02/23/2024 0105 |
| PFDoS | 1.9 | 2.0 | | 1 | 103 | 40-150 | 02/23/2024 0105 |
| PFDoA | 2.0 | 2.1 | | 1 | 104 | 40-150 | 02/23/2024 0105 |
| PFHpS | 1.9 | 2.2 | | 1 | 117 | 40-150 | 02/23/2024 0105 |
| PFHpA | 2.0 | 2.4 | M-03 | 1 | 121 | 40-150 | 02/23/2024 0105 |
| 7:3FTCA | 50 | 49 | | 1 | 98 | 40-150 | 02/23/2024 0105 |
| PFHxS | 1.8 | 2.0 | M-03 | 1 | 110 | 40-150 | 02/23/2024 0105 |
| PFHxA | 2.0 | 2.2 | | 1 | 111 | 40-150 | 02/23/2024 0105 |
| PFNS | 1.9 | 2.2 | | 1 | 112 | 40-150 | 02/23/2024 0105 |
| PFNA | 2.0 | 2.4 | M-03 | 1 | 121 | 40-150 | 02/23/2024 0105 |
| PFOSA | 2.0 | 2.2 | | 1 | 112 | 40-150 | 02/23/2024 0105 |
| PFOS | 1.9 | 2.2 | M-03 | 1 | 121 | 40-150 | 02/23/2024 0105 |
| PFOA | 2.0 | 2.4 | M-03 | 1 | 119 | 40-150 | 02/23/2024 0105 |
| PFPeS | 1.9 | 2.4 | | 1 | 127 | 40-150 | 02/23/2024 0105 |
| PFPeA | 4.0 | 4.7 | | 1 | 118 | 40-150 | 02/23/2024 0105 |
| 3:3FTCA | 10 | 11 | | 1 | 109 | 40-150 | 02/23/2024 0105 |
| PFTeDA | 2.0 | 2.4 | | 1 | 119 | 40-150 | 02/23/2024 0105 |
| PFTrDA | 2.0 | 2.0 | | 1 | 102 | 40-150 | 02/23/2024 0105 |
| PFUnA | 2.0 | 2.3 | | 1 | 113 | 40-150 | 02/23/2024 0105 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 75 | 20-150 |
| 13C2-6:2FTS | | 76 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ96883-102
Batch: 96883
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/21/2024 1208

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 66 | 20-150 |
| 13C2-PFDoA | | 71 | 20-150 |
| 13C2-PFTeDA | | 76 | 20-150 |
| 13C3-HFPO-DA | | 86 | 20-150 |
| 13C3-PFBS | | 77 | 20-150 |
| 13C3-PFHxS | | 75 | 20-150 |
| 13C4-PFBA | | 82 | 20-150 |
| 13C4-PFHpA | | 79 | 20-150 |
| 13C5-PFHxA | | 84 | 20-150 |
| 13C5-PFPeA | | 81 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 |
| 13C7-PFUnA | | 71 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 |
| 13C8-PFOS | | 81 | 20-150 |
| 13C8-PFOSA | | 80 | 20-150 |
| 13C9-PFNA | | 76 | 20-150 |
| D3-NMeFOSA | | 64 | 20-150 |
| D3-NMeFOSAA | | 83 | 20-150 |
| D5-NEtFOSA | | 66 | 20-150 |
| D5-NEtFOSAA | | 79 | 20-150 |
| D7-NMeFOSE | | 75 | 20-150 |
| D9-NEtFOSE | | 73 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ97077-001
Batch: 97077
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/23/2024 1241

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 02/26/2024 1848 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 02/26/2024 1848 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 02/26/2024 1848 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 02/26/2024 1848 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 02/26/2024 1848 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 02/26/2024 1848 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 02/26/2024 1848 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 02/26/2024 1848 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 02/26/2024 1848 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/26/2024 1848 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 02/26/2024 1848 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 02/26/2024 1848 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/26/2024 1848 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 02/26/2024 1848 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 02/26/2024 1848 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 02/26/2024 1848 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 02/26/2024 1848 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 02/26/2024 1848 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 02/26/2024 1848 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 02/26/2024 1848 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 02/26/2024 1848 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/26/2024 1848 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 02/26/2024 1848 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 02/26/2024 1848 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 02/26/2024 1848 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/26/2024 1848 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 02/26/2024 1848 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 02/26/2024 1848 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/26/2024 1848 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 02/26/2024 1848 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 02/26/2024 1848 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 02/26/2024 1848 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 02/26/2024 1848 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/26/2024 1848 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 02/26/2024 1848 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 02/26/2024 1848 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 02/26/2024 1848 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 02/26/2024 1848 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 02/26/2024 1848 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 02/26/2024 1848 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | M-03 | 77 | 20-150 |
| 13C2-6:2FTS | | 81 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MB

Sample ID: ZQ97077-001
Batch: 97077
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/23/2024 1241

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | M-03 | 80 | 20-150 |
| 13C2-PFDoA | | 75 | 20-150 |
| 13C2-PFTeDA | | 71 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 |
| 13C3-PFBS | | 75 | 20-150 |
| 13C3-PFHxS | | 78 | 20-150 |
| 13C4-PFBA | | 76 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 |
| 13C6-PFDA | | 72 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 |
| 13C8-PFOS | | 76 | 20-150 |
| 13C8-PFOSA | | 69 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 |
| D3-NMeFOSA | | 41 | 20-150 |
| D3-NMeFOSAA | | 69 | 20-150 |
| D5-NEtFOSA | | 45 | 20-150 |
| D5-NEtFOSAA | | 75 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 |
| D9-NEtFOSE | | 69 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97077-002
Batch: 97077
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/23/2024 1241

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 120 | | 1 | 131 | 40-150 | 02/26/2024 1858 |
| 9Cl-PF3ONS | 90 | 120 | | 1 | 136 | 40-150 | 02/26/2024 1858 |
| ADONA | 91 | 120 | | 1 | 133 | 40-150 | 02/26/2024 1858 |
| 8:2FTS | 92 | 140 | NM-03 | 1 | 152 | 40-150 | 02/26/2024 1858 |
| 4:2FTS | 90 | 120 | | 1 | 136 | 40-150 | 02/26/2024 1858 |
| 6:2FTS | 91 | 120 | | 1 | 129 | 40-150 | 02/26/2024 1858 |
| 5:3FTCA | 600 | 700 | | 1 | 116 | 40-150 | 02/26/2024 1858 |
| HFPO-DA | 96 | 120 | | 1 | 125 | 40-150 | 02/26/2024 1858 |
| NEtFOSA | 24 | 31 | | 1 | 130 | 40-150 | 02/26/2024 1858 |
| NEtFOSAA | 24 | 31 | M-03 | 1 | 131 | 40-150 | 02/26/2024 1858 |
| NEtFOSE | 240 | 300 | | 1 | 125 | 40-150 | 02/26/2024 1858 |
| NMeFOSA | 24 | 33 | | 1 | 139 | 40-150 | 02/26/2024 1858 |
| NMeFOSAA | 24 | 34 | M-03 | 1 | 143 | 40-150 | 02/26/2024 1858 |
| NMeFOSE | 240 | 300 | | 1 | 126 | 40-150 | 02/26/2024 1858 |
| NFDHA | 48 | 54 | M-03 | 1 | 112 | 40-150 | 02/26/2024 1858 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 51 | | 1 | 120 | 40-150 | 02/26/2024 1858 |
| PFMPA | 48 | 53 | | 1 | 110 | 40-150 | 02/26/2024 1858 |
| PFMBA | 48 | 52 | | 1 | 109 | 40-150 | 02/26/2024 1858 |
| PFBS | 21 | 29 | | 1 | 135 | 40-150 | 02/26/2024 1858 |
| PFBA | 96 | 130 | | 1 | 131 | 40-150 | 02/26/2024 1858 |
| PFDS | 23 | 30 | | 1 | 128 | 40-150 | 02/26/2024 1858 |
| PFDA | 24 | 31 | | 1 | 129 | 40-150 | 02/26/2024 1858 |
| PFDoS | 23 | 29 | | 1 | 123 | 40-150 | 02/26/2024 1858 |
| PFDoA | 24 | 31 | | 1 | 129 | 40-150 | 02/26/2024 1858 |
| PFHpS | 23 | 33 | | 1 | 142 | 40-150 | 02/26/2024 1858 |
| PFHpA | 24 | 29 | | 1 | 122 | 40-150 | 02/26/2024 1858 |
| 7:3FTCA | 600 | 620 | | 1 | 103 | 40-150 | 02/26/2024 1858 |
| PFHxS | 22 | 30 | M-03 | 1 | 135 | 40-150 | 02/26/2024 1858 |
| PFHxA | 24 | 30 | | 1 | 124 | 40-150 | 02/26/2024 1858 |
| PFNS | 23 | 31 | | 1 | 132 | 40-150 | 02/26/2024 1858 |
| PFNA | 24 | 30 | | 1 | 123 | 40-150 | 02/26/2024 1858 |
| PFOSA | 24 | 31 | | 1 | 128 | 40-150 | 02/26/2024 1858 |
| PFOS | 22 | 31 | M-03 | 1 | 140 | 40-150 | 02/26/2024 1858 |
| PFOA | 24 | 30 | | 1 | 123 | 40-150 | 02/26/2024 1858 |
| PFPeS | 23 | 29 | | 1 | 129 | 40-150 | 02/26/2024 1858 |
| PFPeA | 48 | 65 | | 1 | 135 | 40-150 | 02/26/2024 1858 |
| 3:3FTCA | 120 | 130 | | 1 | 109 | 40-150 | 02/26/2024 1858 |
| PFTeDA | 24 | 32 | | 1 | 132 | 40-150 | 02/26/2024 1858 |
| PFTrDA | 24 | 31 | | 1 | 128 | 40-150 | 02/26/2024 1858 |
| PFUnA | 24 | 31 | | 1 | 128 | 40-150 | 02/26/2024 1858 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 77 | 20-150 |
| 13C2-6:2FTS | | 76 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97077-002
Batch: 97077
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/23/2024 1241

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 76 | 20-150 |
| 13C2-PFDoA | | 67 | 20-150 |
| 13C2-PFTeDA | | 67 | 20-150 |
| 13C3-HFPO-DA | | 78 | 20-150 |
| 13C3-PFBS | | 77 | 20-150 |
| 13C3-PFHxS | | 81 | 20-150 |
| 13C4-PFBA | | 78 | 20-150 |
| 13C4-PFHpA | | 88 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 |
| 13C6-PFDA | | 68 | 20-150 |
| 13C7-PFUnA | | 68 | 20-150 |
| 13C8-PFOA | | 68 | 20-150 |
| 13C8-PFOS | | 68 | 20-150 |
| 13C8-PFOSA | | 67 | 20-150 |
| 13C9-PFNA | M-03 | 81 | 20-150 |
| D3-NMeFOSA | | 38 | 20-150 |
| D3-NMeFOSAA | | 64 | 20-150 |
| D5-NEtFOSA | | 44 | 20-150 |
| D5-NEtFOSAA | M-03 | 68 | 20-150 |
| D7-NMeFOSE | | 68 | 20-150 |
| D9-NEtFOSE | | 68 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97077-102
Batch: 97077
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/23/2024 1241

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.9 | | 1 | 105 | 40-150 | 02/26/2024 1907 |
| 9Cl-PF3ONS | 7.5 | 8.2 | | 1 | 109 | 40-150 | 02/26/2024 1907 |
| ADONA | 7.6 | 9.9 | | 1 | 130 | 40-150 | 02/26/2024 1907 |
| 8:2FTS | 7.7 | 9.6 | | 1 | 125 | 40-150 | 02/26/2024 1907 |
| 4:2FTS | 7.5 | 8.5 | M-03 | 1 | 113 | 40-150 | 02/26/2024 1907 |
| 6:2FTS | 7.6 | 8.2 | | 1 | 108 | 40-150 | 02/26/2024 1907 |
| 5:3FTCA | 50 | 58 | | 1 | 115 | 40-150 | 02/26/2024 1907 |
| HFPO-DA | 8.0 | 9.1 | | 1 | 114 | 40-150 | 02/26/2024 1907 |
| NEtFOSA | 2.0 | 2.2 | M-03 | 1 | 112 | 40-150 | 02/26/2024 1907 |
| NEtFOSAA | 2.0 | 2.2 | M-03 | 1 | 110 | 40-150 | 02/26/2024 1907 |
| NEtFOSE | 20 | 18 | | 1 | 92 | 40-150 | 02/26/2024 1907 |
| NMeFOSA | 2.0 | 2.1 | M-03 | 1 | 106 | 40-150 | 02/26/2024 1907 |
| NMeFOSAA | 2.0 | 2.3 | M-03 | 1 | 113 | 40-150 | 02/26/2024 1907 |
| NMeFOSE | 20 | 22 | | 1 | 110 | 40-150 | 02/26/2024 1907 |
| NFDHA | 4.0 | 4.6 | | 1 | 114 | 40-150 | 02/26/2024 1907 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.5 | | 1 | 126 | 40-150 | 02/26/2024 1907 |
| PFMPA | 4.0 | 4.6 | M-03 | 1 | 114 | 40-150 | 02/26/2024 1907 |
| PFMBA | 4.0 | 4.4 | | 1 | 109 | 40-150 | 02/26/2024 1907 |
| PFBS | 1.8 | 2.3 | M-03 | 1 | 128 | 40-150 | 02/26/2024 1907 |
| PFBA | 8.0 | 9.8 | | 1 | 123 | 40-150 | 02/26/2024 1907 |
| PFDS | 1.9 | 2.2 | | 1 | 113 | 40-150 | 02/26/2024 1907 |
| PFDA | 2.0 | 2.2 | M-03 | 1 | 110 | 40-150 | 02/26/2024 1907 |
| PFDoS | 1.9 | 1.9 | | 1 | 95 | 40-150 | 02/26/2024 1907 |
| PFDoA | 2.0 | 2.5 | M-03 | 1 | 125 | 40-150 | 02/26/2024 1907 |
| PFHpS | 1.9 | 2.4 | M-03 | 1 | 126 | 40-150 | 02/26/2024 1907 |
| PFHpA | 2.0 | 2.4 | | 1 | 121 | 40-150 | 02/26/2024 1907 |
| 7:3FTCA | 50 | 52 | | 1 | 104 | 40-150 | 02/26/2024 1907 |
| PFHxS | 1.8 | 2.2 | M-03 | 1 | 122 | 40-150 | 02/26/2024 1907 |
| PFHxA | 2.0 | 2.4 | M-03 | 1 | 118 | 40-150 | 02/26/2024 1907 |
| PFNS | 1.9 | 2.5 | | 1 | 130 | 40-150 | 02/26/2024 1907 |
| PFNA | 2.0 | 2.5 | | 1 | 123 | 40-150 | 02/26/2024 1907 |
| PFOSA | 2.0 | 2.5 | | 1 | 124 | 40-150 | 02/26/2024 1907 |
| PFOS | 1.9 | 2.3 | M-03 | 1 | 122 | 40-150 | 02/26/2024 1907 |
| PFOA | 2.0 | 2.1 | M-03 | 1 | 104 | 40-150 | 02/26/2024 1907 |
| PFPeS | 1.9 | 2.3 | M-03 | 1 | 123 | 40-150 | 02/26/2024 1907 |
| PFPeA | 4.0 | 4.7 | | 1 | 116 | 40-150 | 02/26/2024 1907 |
| 3:3FTCA | 10 | 11 | M-03 | 1 | 110 | 40-150 | 02/26/2024 1907 |
| PFTeDA | 2.0 | 2.5 | | 1 | 125 | 40-150 | 02/26/2024 1907 |
| PFTrDA | 2.0 | 2.5 | M-03 | 1 | 125 | 40-150 | 02/26/2024 1907 |
| PFUnA | 2.0 | 2.4 | M-03 | 1 | 119 | 40-150 | 02/26/2024 1907 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 76 | 20-150 |
| 13C2-6:2FTS | | 70 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97077-102
Batch: 97077
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/23/2024 1241

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 63 | 20-150 |
| 13C2-PFDoA | | 62 | 20-150 |
| 13C2-PFTeDA | | 49 | 20-150 |
| 13C3-HFPO-DA | | 80 | 20-150 |
| 13C3-PFBS | | 76 | 20-150 |
| 13C3-PFHxS | | 74 | 20-150 |
| 13C4-PFBA | | 76 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 |
| 13C5-PFPeA | | 86 | 20-150 |
| 13C6-PFDA | | 72 | 20-150 |
| 13C7-PFUnA | | 69 | 20-150 |
| 13C8-PFOA | | 76 | 20-150 |
| 13C8-PFOS | | 74 | 20-150 |
| 13C8-PFOSA | | 69 | 20-150 |
| 13C9-PFNA | | 73 | 20-150 |
| D3-NMeFOSA | | 42 | 20-150 |
| D3-NMeFOSAA | | 72 | 20-150 |
| D5-NEtFOSA | | 44 | 20-150 |
| D5-NEtFOSAA | | 71 | 20-150 |
| D7-NMeFOSE | | 47 | 20-150 |
| D9-NEtFOSE | | 20 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZA29006-028MS
Batch: 97077
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/23/2024 1241

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 450 | 500 | | 1 | 109 | 40-150 | 02/26/2024 2029 |
| 9Cl-PF3ONS | ND | 450 | 560 | | 1 | 126 | 40-150 | 02/26/2024 2029 |
| ADONA | ND | 450 | 560 | | 1 | 123 | 40-150 | 02/26/2024 2029 |
| 8:2FTS | 5.6 | 460 | 590 | | 1 | 128 | 40-150 | 02/26/2024 2029 |
| 4:2FTS | ND | 450 | 560 | | 1 | 124 | 40-150 | 02/26/2024 2029 |
| 6:2FTS | ND | 460 | 540 | | 1 | 118 | 40-150 | 02/26/2024 2029 |
| 5:3FTCA | ND | 3000 | 3200 | | 1 | 107 | 40-150 | 02/26/2024 2029 |
| HFPO-DA | ND | 480 | 520 | | 1 | 109 | 40-150 | 02/26/2024 2029 |
| NEtFOSA | ND | 120 | 130 | | 1 | 108 | 40-150 | 02/26/2024 2029 |
| NEtFOSAA | ND | 120 | 140 | M-03 | 1 | 120 | 40-150 | 02/26/2024 2029 |
| NEtFOSE | ND | 1200 | 1300 | | 1 | 110 | 40-150 | 02/26/2024 2029 |
| NMeFOSA | ND | 120 | 140 | | 1 | 119 | 40-150 | 02/26/2024 2029 |
| NMeFOSAA | ND | 120 | 150 | M-03 | 1 | 127 | 40-150 | 02/26/2024 2029 |
| NMeFOSE | ND | 1200 | 1400 | | 1 | 114 | 40-150 | 02/26/2024 2029 |
| NFDHA | ND | 240 | 250 | | 1 | 104 | 40-150 | 02/26/2024 2029 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 210 | 240 | | 1 | 113 | 40-150 | 02/26/2024 2029 |
| PFMPA | ND | 240 | 240 | | 1 | 102 | 40-150 | 02/26/2024 2029 |
| PFMBA | ND | 240 | 240 | | 1 | 100 | 40-150 | 02/26/2024 2029 |
| PFBS | 6.5 | 110 | 130 | | 1 | 114 | 40-150 | 02/26/2024 2029 |
| PFBA | 9.7 | 480 | 590 | | 1 | 122 | 40-150 | 02/26/2024 2029 |
| PFDS | ND | 120 | 140 | | 1 | 121 | 40-150 | 02/26/2024 2029 |
| PFDA | ND | 120 | 140 | | 1 | 114 | 40-150 | 02/26/2024 2029 |
| PFDoS | ND | 120 | 100 | | 1 | 89 | 40-150 | 02/26/2024 2029 |
| PFDoA | ND | 120 | 150 | | 1 | 122 | 40-150 | 02/26/2024 2029 |
| PFHpS | 15 | 110 | 180 | M-03 | 1 | 146 | 40-150 | 02/26/2024 2029 |
| PFHpA | 12 | 120 | 150 | | 1 | 116 | 40-150 | 02/26/2024 2029 |
| 7:3FTCA | ND | 3000 | 3000 | | 1 | 101 | 40-150 | 02/26/2024 2029 |
| PFHxS | 200 | 110 | 330 | M-03 | 1 | 116 | 40-150 | 02/26/2024 2029 |
| PFHxA | 17 | 120 | 160 | | 1 | 115 | 40-150 | 02/26/2024 2029 |
| PFNS | ND | 120 | 150 | | 1 | 126 | 40-150 | 02/26/2024 2029 |
| PFNA | 6.2 | 120 | 150 | | 1 | 122 | 40-150 | 02/26/2024 2029 |
| PFOSA | 1.5 | 120 | 140 | | 1 | 118 | 40-150 | 02/26/2024 2029 |
| PFOS | 1000 | 110 | 1000 | NM-03 | 1 | 9.5 | 40-150 | 02/26/2024 2029 |
| PFOA | 35 | 120 | 190 | M-03 | 1 | 132 | 40-150 | 02/26/2024 2029 |
| PFPeS | 9.0 | 110 | 150 | | 1 | 125 | 40-150 | 02/26/2024 2029 |
| PFPeA | 11 | 240 | 300 | | 1 | 119 | 40-150 | 02/26/2024 2029 |
| 3:3FTCA | ND | 600 | 570 | | 1 | 95 | 40-150 | 02/26/2024 2029 |
| PFTeDA | ND | 120 | 140 | | 1 | 119 | 40-150 | 02/26/2024 2029 |
| PFTrDA | ND | 120 | 120 | | 1 | 103 | 40-150 | 02/26/2024 2029 |
| PFUnA | ND | 120 | 140 | | 1 | 118 | 40-150 | 02/26/2024 2029 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 84 | 20-150 |
| 13C2-6:2FTS | | 74 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZA29006-028MS
Batch: 97077
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/23/2024 1241

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 81 | 20-150 |
| 13C2-PFDoA | | 67 | 20-150 |
| 13C2-PFTeDA | | 49 | 20-150 |
| 13C3-HFPO-DA | | 84 | 20-150 |
| 13C3-PFBS | | 86 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 |
| 13C4-PFBA | | 83 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 |
| 13C5-PFHxA | | 84 | 20-150 |
| 13C5-PFPeA | | 91 | 20-150 |
| 13C6-PFDA | | 75 | 20-150 |
| 13C7-PFUnA | | 70 | 20-150 |
| 13C8-PFOA | | 76 | 20-150 |
| 13C8-PFOS | | 79 | 20-150 |
| 13C8-PFOSA | | 77 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 |
| D3-NMeFOSA | | 58 | 20-150 |
| D3-NMeFOSAA | | 73 | 20-150 |
| D5-NEtFOSA | | 56 | 20-150 |
| D5-NEtFOSAA | | 64 | 20-150 |
| D7-NMeFOSE | | 58 | 20-150 |
| D9-NEtFOSE | | 49 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: ZA29006-028MD
Batch: 97077
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/23/2024 1241

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 450 | 420 | | 1 | 93 | 16 | 40-150 | 30 | 02/26/2024 2039 |
| 9Cl-PF3ONS | ND | 450 | 550 | | 1 | 122 | 3.1 | 40-150 | 30 | 02/26/2024 2039 |
| ADONA | ND | 450 | 550 | | 1 | 121 | 1.6 | 40-150 | 30 | 02/26/2024 2039 |
| 8:2FTS | 5.6 | 460 | 570 | | 1 | 123 | 3.7 | 40-150 | 30 | 02/26/2024 2039 |
| 4:2FTS | ND | 450 | 560 | | 1 | 124 | 0.11 | 40-150 | 30 | 02/26/2024 2039 |
| 6:2FTS | ND | 460 | 600 | | 1 | 131 | 9.9 | 40-150 | 30 | 02/26/2024 2039 |
| 5:3FTCA | ND | 3000 | 2900 | | 1 | 97 | 9.8 | 40-150 | 30 | 02/26/2024 2039 |
| HFPO-DA | ND | 480 | 570 | | 1 | 119 | 8.1 | 40-150 | 30 | 02/26/2024 2039 |
| NEtFOSA | ND | 120 | 140 | | 1 | 119 | 10 | 40-150 | 30 | 02/26/2024 2039 |
| NEtFOSAA | ND | 120 | 150 | M-03 | 1 | 126 | 4.3 | 40-150 | 30 | 02/26/2024 2039 |
| NEtFOSE | ND | 1200 | 1200 | M-03 | 1 | 104 | 5.7 | 40-150 | 30 | 02/26/2024 2039 |
| NMeFOSA | ND | 120 | 150 | | 1 | 124 | 3.6 | 40-150 | 30 | 02/26/2024 2039 |
| NMeFOSAA | ND | 120 | 160 | M-03 | 1 | 133 | 4.1 | 40-150 | 30 | 02/26/2024 2039 |
| NMeFOSE | ND | 1200 | 1200 | | 1 | 99 | 15 | 40-150 | 30 | 02/26/2024 2039 |
| NFDHA | ND | 240 | 250 | | 1 | 103 | 1.3 | 40-150 | 30 | 02/26/2024 2039 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 210 | 250 | | 1 | 119 | 5.3 | 40-150 | 30 | 02/26/2024 2039 |
| PFMPA | ND | 240 | 250 | | 1 | 104 | 2.3 | 40-150 | 30 | 02/26/2024 2039 |
| PFMBA | ND | 240 | 250 | | 1 | 103 | 3.9 | 40-150 | 30 | 02/26/2024 2039 |
| PFBS | 6.5 | 110 | 140 | | 1 | 124 | 7.9 | 40-150 | 30 | 02/26/2024 2039 |
| PFBA | 9.7 | 480 | 630 | | 1 | 129 | 5.7 | 40-150 | 30 | 02/26/2024 2039 |
| PFDS | ND | 120 | 130 | | 1 | 112 | 8.2 | 40-150 | 30 | 02/26/2024 2039 |
| PFDA | ND | 120 | 160 | | 1 | 130 | 13 | 40-150 | 30 | 02/26/2024 2039 |
| PFDoS | ND | 120 | 59 | + | 1 | 51 | 54 | 40-150 | 30 | 02/26/2024 2039 |
| PFDoA | ND | 120 | 150 | | 1 | 121 | 1.2 | 40-150 | 30 | 02/26/2024 2039 |
| PFHpS | 15 | 110 | 170 | | 1 | 139 | 5.0 | 40-150 | 30 | 02/26/2024 2039 |
| PFHpA | 12 | 120 | 150 | | 1 | 113 | 2.4 | 40-150 | 30 | 02/26/2024 2039 |
| 7:3FTCA | ND | 3000 | 3100 | | 1 | 103 | 1.8 | 40-150 | 30 | 02/26/2024 2039 |
| PFHxS | 200 | 110 | 340 | M-03 | 1 | 127 | 3.7 | 40-150 | 30 | 02/26/2024 2039 |
| PFHxA | 17 | 120 | 160 | | 1 | 115 | 0.036 | 40-150 | 30 | 02/26/2024 2039 |
| PFNS | ND | 120 | 140 | | 1 | 125 | 1.1 | 40-150 | 30 | 02/26/2024 2039 |
| PFNA | 6.2 | 120 | 150 | | 1 | 121 | 0.65 | 40-150 | 30 | 02/26/2024 2039 |
| PFOSA | 1.5 | 120 | 150 | | 1 | 126 | 6.6 | 40-150 | 30 | 02/26/2024 2039 |
| PFOS | 1000 | 110 | 1100 | M-03 | 1 | 63 | 5.5 | 40-150 | 30 | 02/26/2024 2039 |
| PFOA | 35 | 120 | 190 | M-03 | 1 | 128 | 2.8 | 40-150 | 30 | 02/26/2024 2039 |
| PFPeS | 9.0 | 110 | 150 | | 1 | 128 | 2.3 | 40-150 | 30 | 02/26/2024 2039 |
| PFPeA | 11 | 240 | 330 | | 1 | 132 | 10 | 40-150 | 30 | 02/26/2024 2039 |
| 3:3FTCA | ND | 600 | 600 | M-03 | 1 | 100 | 4.7 | 40-150 | 30 | 02/26/2024 2039 |
| PFTeDA | ND | 120 | 150 | | 1 | 121 | 1.4 | 40-150 | 30 | 02/26/2024 2039 |
| PFTrDA | ND | 120 | 110 | | 1 | 92 | 11 | 40-150 | 30 | 02/26/2024 2039 |
| PFUnA | ND | 120 | 150 | | 1 | 128 | 7.8 | 40-150 | 30 | 02/26/2024 2039 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 76 | 20-150 |
| 13C2-6:2FTS | | 71 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: ZA29006-028MD
Batch: 97077
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/23/2024 1241

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | M-03 | 77 | 20-150 |
| 13C2-PFDoA | | 62 | 20-150 |
| 13C2-PFTeDA | | 28 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 |
| 13C3-PFBS | | 79 | 20-150 |
| 13C3-PFHxS | | 77 | 20-150 |
| 13C4-PFBA | | 83 | 20-150 |
| 13C4-PFHpA | | 91 | 20-150 |
| 13C5-PFHxA | | 86 | 20-150 |
| 13C5-PFPeA | | 92 | 20-150 |
| 13C6-PFDA | | 75 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 |
| 13C8-PFOA | | 80 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 |
| 13C8-PFOSA | | 75 | 20-150 |
| 13C9-PFNA | | 83 | 20-150 |
| D3-NMeFOSA | | 54 | 20-150 |
| D3-NMeFOSAA | | 66 | 20-150 |
| D5-NEtFOSA | | 49 | 20-150 |
| D5-NEtFOSAA | | 62 | 20-150 |
| D7-NMeFOSE | M-03N | 1.0 | 20-150 |
| D9-NEtFOSE | N | 0.00 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ97189-001
Batch: 97189
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/26/2024 1200

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 02/27/2024 2159 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 02/27/2024 2159 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 02/27/2024 2159 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 02/27/2024 2159 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 02/27/2024 2159 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 02/27/2024 2159 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 02/27/2024 2159 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 02/27/2024 2159 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 02/27/2024 2159 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/27/2024 2159 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 02/27/2024 2159 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 02/27/2024 2159 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/27/2024 2159 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 02/27/2024 2159 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 02/27/2024 2159 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 02/27/2024 2159 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 02/27/2024 2159 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 02/27/2024 2159 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 02/27/2024 2159 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 02/27/2024 2159 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 02/27/2024 2159 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/27/2024 2159 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 02/27/2024 2159 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 02/27/2024 2159 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 02/27/2024 2159 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/27/2024 2159 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 02/27/2024 2159 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 02/27/2024 2159 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/27/2024 2159 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 02/27/2024 2159 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 02/27/2024 2159 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 02/27/2024 2159 |
| PFOS | 0.43 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 02/27/2024 2159 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/27/2024 2159 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 02/27/2024 2159 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 02/27/2024 2159 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 02/27/2024 2159 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 02/27/2024 2159 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 02/27/2024 2159 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 02/27/2024 2159 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 78 | 20-150 |
| 13C2-6:2FTS | | 75 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ97189-001
Batch: 97189
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/26/2024 1200

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 69 | 20-150 |
| 13C2-PFDoA | | 68 | 20-150 |
| 13C2-PFTeDA | | 63 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 |
| 13C3-PFBS | | 74 | 20-150 |
| 13C3-PFHxS | | 74 | 20-150 |
| 13C4-PFBA | | 80 | 20-150 |
| 13C4-PFHpA | | 80 | 20-150 |
| 13C5-PFHxA | | 78 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 |
| 13C6-PFDA | | 82 | 20-150 |
| 13C7-PFUnA | | 69 | 20-150 |
| 13C8-PFOA | | 70 | 20-150 |
| 13C8-PFOS | | 71 | 20-150 |
| 13C8-PFOSA | | 76 | 20-150 |
| 13C9-PFNA | | 79 | 20-150 |
| D3-NMeFOSA | | 55 | 20-150 |
| D3-NMeFOSAA | | 74 | 20-150 |
| D5-NEtFOSA | | 57 | 20-150 |
| D5-NEtFOSAA | | 70 | 20-150 |
| D7-NMeFOSE | | 67 | 20-150 |
| D9-NEtFOSE | | 66 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97189-002
Batch: 97189
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/26/2024 1200

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 95 | | 1 | 105 | 40-150 | 02/27/2024 2208 |
| 9Cl-PF3ONS | 90 | 110 | | 1 | 117 | 40-150 | 02/27/2024 2208 |
| ADONA | 91 | 110 | | 1 | 117 | 40-150 | 02/27/2024 2208 |
| 8:2FTS | 92 | 160 | N | 1 | 179 | 40-150 | 02/27/2024 2208 |
| 4:2FTS | 90 | 160 | N | 1 | 176 | 40-150 | 02/27/2024 2208 |
| 6:2FTS | 91 | 150 | N | 1 | 159 | 40-150 | 02/27/2024 2208 |
| 5:3FTCA | 600 | 700 | | 1 | 117 | 40-150 | 02/27/2024 2208 |
| HFPO-DA | 96 | 110 | | 1 | 115 | 40-150 | 02/27/2024 2208 |
| NEtFOSA | 24 | 38 | N | 1 | 157 | 40-150 | 02/27/2024 2208 |
| NEtFOSAA | 24 | 38 | N | 1 | 158 | 40-150 | 02/27/2024 2208 |
| NEtFOSE | 240 | 420 | N | 1 | 173 | 40-150 | 02/27/2024 2208 |
| NMeFOSA | 24 | 39 | N | 1 | 163 | 40-150 | 02/27/2024 2208 |
| NMeFOSAA | 24 | 42 | N | 1 | 176 | 40-150 | 02/27/2024 2208 |
| NMeFOSE | 240 | 420 | N | 1 | 173 | 40-150 | 02/27/2024 2208 |
| NFDHA | 48 | 56 | | 1 | 117 | 40-150 | 02/27/2024 2208 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 47 | | 1 | 110 | 40-150 | 02/27/2024 2208 |
| PFMPA | 48 | 50 | | 1 | 104 | 40-150 | 02/27/2024 2208 |
| PFMBA | 48 | 49 | | 1 | 102 | 40-150 | 02/27/2024 2208 |
| PFBS | 21 | 37 | N | 1 | 174 | 40-150 | 02/27/2024 2208 |
| PFBA | 96 | 170 | N | 1 | 174 | 40-150 | 02/27/2024 2208 |
| PFDS | 23 | 37 | N | 1 | 161 | 40-150 | 02/27/2024 2208 |
| PFDA | 24 | 39 | N | 1 | 162 | 40-150 | 02/27/2024 2208 |
| PFDoS | 23 | 36 | N | 1 | 155 | 40-150 | 02/27/2024 2208 |
| PFDoA | 24 | 40 | N | 1 | 165 | 40-150 | 02/27/2024 2208 |
| PFHpS | 23 | 41 | N | 1 | 181 | 40-150 | 02/27/2024 2208 |
| PFHpA | 24 | 41 | N | 1 | 169 | 40-150 | 02/27/2024 2208 |
| 7:3FTCA | 600 | 680 | | 1 | 113 | 40-150 | 02/27/2024 2208 |
| PFHxS | 22 | 36 | N | 1 | 163 | 40-150 | 02/27/2024 2208 |
| PFHxA | 24 | 42 | N | 1 | 174 | 40-150 | 02/27/2024 2208 |
| PFNS | 23 | 40 | N | 1 | 172 | 40-150 | 02/27/2024 2208 |
| PFNA | 24 | 41 | N | 1 | 169 | 40-150 | 02/27/2024 2208 |
| PFOSA | 24 | 40 | N | 1 | 168 | 40-150 | 02/27/2024 2208 |
| PFOS | 22 | 42 | NM-03 | 1 | 190 | 40-150 | 02/27/2024 2208 |
| PFOA | 24 | 43 | N | 1 | 177 | 40-150 | 02/27/2024 2208 |
| PFPeS | 23 | 38 | N | 1 | 167 | 40-150 | 02/27/2024 2208 |
| PFPeA | 48 | 84 | N | 1 | 174 | 40-150 | 02/27/2024 2208 |
| 3:3FTCA | 120 | 130 | | 1 | 107 | 40-150 | 02/27/2024 2208 |
| PFTeDA | 24 | 40 | N | 1 | 168 | 40-150 | 02/27/2024 2208 |
| PFTrDA | 24 | 38 | N | 1 | 158 | 40-150 | 02/27/2024 2208 |
| PFUnA | 24 | 41 | N | 1 | 172 | 40-150 | 02/27/2024 2208 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 83 | 20-150 |
| 13C2-6:2FTS | | 85 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97189-002
Batch: 97189
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/26/2024 1200

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 81 | 20-150 |
| 13C2-PFDoA | | 76 | 20-150 |
| 13C2-PFTeDA | | 71 | 20-150 |
| 13C3-HFPO-DA | | 84 | 20-150 |
| 13C3-PFBS | | 83 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 |
| 13C6-PFDA | | 82 | 20-150 |
| 13C7-PFUnA | | 75 | 20-150 |
| 13C8-PFOA | | 81 | 20-150 |
| 13C8-PFOS | | 81 | 20-150 |
| 13C8-PFOSA | | 85 | 20-150 |
| 13C9-PFNA | | 80 | 20-150 |
| D3-NMeFOSA | | 64 | 20-150 |
| D3-NMeFOSAA | | 82 | 20-150 |
| D5-NEtFOSA | | 67 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 |
| D7-NMeFOSE | | 70 | 20-150 |
| D9-NEtFOSE | | 72 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97189-102
Batch: 97189
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/26/2024 1200

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.8 | | 1 | 104 | 40-150 | 02/27/2024 2217 |
| 9Cl-PF3ONS | 7.5 | 8.5 | | 1 | 114 | 40-150 | 02/27/2024 2217 |
| ADONA | 7.6 | 9.7 | | 1 | 128 | 40-150 | 02/27/2024 2217 |
| 8:2FTS | 7.7 | 7.9 | | 1 | 103 | 40-150 | 02/27/2024 2217 |
| 4:2FTS | 7.5 | 9.4 | | 1 | 125 | 40-150 | 02/27/2024 2217 |
| 6:2FTS | 7.6 | 8.7 | | 1 | 114 | 40-150 | 02/27/2024 2217 |
| 5:3FTCA | 50 | 63 | | 1 | 125 | 40-150 | 02/27/2024 2217 |
| HFPO-DA | 8.0 | 8.3 | M-03 | 1 | 104 | 40-150 | 02/27/2024 2217 |
| NEtFOSA | 2.0 | 2.5 | M-03 | 1 | 125 | 40-150 | 02/27/2024 2217 |
| NEtFOSAA | 2.0 | 2.4 | M-03 | 1 | 122 | 40-150 | 02/27/2024 2217 |
| NEtFOSE | 20 | 23 | | 1 | 114 | 40-150 | 02/27/2024 2217 |
| NMeFOSA | 2.0 | 2.5 | | 1 | 126 | 40-150 | 02/27/2024 2217 |
| NMeFOSAA | 2.0 | 2.8 | M-03 | 1 | 141 | 40-150 | 02/27/2024 2217 |
| NMeFOSE | 20 | 23 | | 1 | 117 | 40-150 | 02/27/2024 2217 |
| NFDHA | 4.0 | 5.5 | | 1 | 139 | 40-150 | 02/27/2024 2217 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.5 | M-03 | 1 | 126 | 40-150 | 02/27/2024 2217 |
| PFMPA | 4.0 | 4.6 | | 1 | 116 | 40-150 | 02/27/2024 2217 |
| PFMBA | 4.0 | 4.4 | | 1 | 110 | 40-150 | 02/27/2024 2217 |
| PFBS | 1.8 | 2.1 | | 1 | 118 | 40-150 | 02/27/2024 2217 |
| PFBA | 8.0 | 9.6 | | 1 | 121 | 40-150 | 02/27/2024 2217 |
| PFDS | 1.9 | 2.0 | M-03 | 1 | 105 | 40-150 | 02/27/2024 2217 |
| PFDA | 2.0 | 2.5 | | 1 | 123 | 40-150 | 02/27/2024 2217 |
| PFDoS | 1.9 | 2.1 | | 1 | 107 | 40-150 | 02/27/2024 2217 |
| PFDoA | 2.0 | 2.5 | M-03 | 1 | 123 | 40-150 | 02/27/2024 2217 |
| PFHpS | 1.9 | 2.4 | M-03 | 1 | 127 | 40-150 | 02/27/2024 2217 |
| PFHpA | 2.0 | 2.4 | | 1 | 120 | 40-150 | 02/27/2024 2217 |
| 7:3FTCA | 50 | 61 | | 1 | 123 | 40-150 | 02/27/2024 2217 |
| PFHxS | 1.8 | 2.2 | | 1 | 119 | 40-150 | 02/27/2024 2217 |
| PFHxA | 2.0 | 2.3 | | 1 | 113 | 40-150 | 02/27/2024 2217 |
| PFNS | 1.9 | 2.1 | | 1 | 110 | 40-150 | 02/27/2024 2217 |
| PFNA | 2.0 | 2.2 | M-03 | 1 | 109 | 40-150 | 02/27/2024 2217 |
| PFOSA | 2.0 | 2.5 | | 1 | 127 | 40-150 | 02/27/2024 2217 |
| PFOS | 1.9 | 2.5 | M-03 | 1 | 134 | 40-150 | 02/27/2024 2217 |
| PFOA | 2.0 | 2.6 | M-03 | 1 | 132 | 40-150 | 02/27/2024 2217 |
| PFPeS | 1.9 | 2.3 | | 1 | 124 | 40-150 | 02/27/2024 2217 |
| PFPeA | 4.0 | 4.7 | | 1 | 117 | 40-150 | 02/27/2024 2217 |
| 3:3FTCA | 10 | 11 | | 1 | 112 | 40-150 | 02/27/2024 2217 |
| PFTeDA | 2.0 | 2.2 | | 1 | 112 | 40-150 | 02/27/2024 2217 |
| PFTrDA | 2.0 | 2.4 | | 1 | 118 | 40-150 | 02/27/2024 2217 |
| PFUnA | 2.0 | 2.2 | | 1 | 112 | 40-150 | 02/27/2024 2217 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 84 | 20-150 |
| 13C2-6:2FTS | | 82 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97189-102
Batch: 97189
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/26/2024 1200

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 81 | 20-150 |
| 13C2-PFDoA | | 70 | 20-150 |
| 13C2-PFTeDA | | 69 | 20-150 |
| 13C3-HFPO-DA | | 86 | 20-150 |
| 13C3-PFBS | | 80 | 20-150 |
| 13C3-PFHxS | | 78 | 20-150 |
| 13C4-PFBA | | 83 | 20-150 |
| 13C4-PFHpA | | 87 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 |
| 13C6-PFDA | | 82 | 20-150 |
| 13C7-PFUnA | | 75 | 20-150 |
| 13C8-PFOA | | 80 | 20-150 |
| 13C8-PFOS | | 81 | 20-150 |
| 13C8-PFOSA | | 81 | 20-150 |
| 13C9-PFNA | | 83 | 20-150 |
| D3-NMeFOSA | | 53 | 20-150 |
| D3-NMeFOSAA | | 84 | 20-150 |
| D5-NEtFOSA | | 54 | 20-150 |
| D5-NEtFOSAA | | 78 | 20-150 |
| D7-NMeFOSE | | 70 | 20-150 |
| D9-NEtFOSE | | 69 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ97343-001
Batch: 97343
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/27/2024 1815

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 02/28/2024 2003 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 02/28/2024 2003 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 02/28/2024 2003 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 02/28/2024 2003 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 02/28/2024 2003 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 02/28/2024 2003 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 02/28/2024 2003 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 02/28/2024 2003 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 02/28/2024 2003 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/28/2024 2003 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 02/28/2024 2003 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 02/28/2024 2003 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 02/28/2024 2003 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 02/28/2024 2003 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 02/28/2024 2003 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 02/28/2024 2003 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 02/28/2024 2003 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 02/28/2024 2003 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 02/28/2024 2003 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 02/28/2024 2003 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 02/28/2024 2003 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/28/2024 2003 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 02/28/2024 2003 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 02/28/2024 2003 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 02/28/2024 2003 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/28/2024 2003 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 02/28/2024 2003 |
| PFHxS | 0.73 | UM-08 | 1 | 1.0 | 0.73 | 0.18 | ng/L | 02/28/2024 2003 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 02/28/2024 2003 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 02/28/2024 2003 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 02/28/2024 2003 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 02/28/2024 2003 |
| PFOS | 0.96 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 02/28/2024 2003 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 02/28/2024 2003 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 02/28/2024 2003 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 02/28/2024 2003 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 02/28/2024 2003 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 02/28/2024 2003 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 02/28/2024 2003 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 02/28/2024 2003 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 92 | 20-150 |
| 13C2-6:2FTS | | 86 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ97343-001
Batch: 97343
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/27/2024 1815

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 85 | 20-150 |
| 13C2-PFDoA | | 91 | 20-150 |
| 13C2-PFTeDA | | 90 | 20-150 |
| 13C3-HFPO-DA | | 96 | 20-150 |
| 13C3-PFBS | | 88 | 20-150 |
| 13C3-PFHxS | | 95 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 |
| 13C4-PFHpA | | 94 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 |
| 13C5-PFPeA | | 97 | 20-150 |
| 13C6-PFDA | | 85 | 20-150 |
| 13C7-PFUnA | | 84 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 |
| 13C8-PFOS | | 85 | 20-150 |
| 13C8-PFOSA | | 93 | 20-150 |
| 13C9-PFNA | | 87 | 20-150 |
| D3-NMeFOSA | | 72 | 20-150 |
| D3-NMeFOSAA | | 84 | 20-150 |
| D5-NEtFOSA | | 71 | 20-150 |
| D5-NEtFOSAA | | 91 | 20-150 |
| D7-NMeFOSE | | 79 | 20-150 |
| D9-NEtFOSE | | 78 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97343-002
Batch: 97343
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/27/2024 1815

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 100 | | 1 | 115 | 40-150 | 02/28/2024 2012 |
| 9Cl-PF3ONS | 90 | 110 | | 1 | 118 | 40-150 | 02/28/2024 2012 |
| ADONA | 91 | 100 | | 1 | 115 | 40-150 | 02/28/2024 2012 |
| 8:2FTS | 92 | 95 | | 1 | 104 | 40-150 | 02/28/2024 2012 |
| 4:2FTS | 90 | 93 | | 1 | 103 | 40-150 | 02/28/2024 2012 |
| 6:2FTS | 91 | 86 | | 1 | 95 | 40-150 | 02/28/2024 2012 |
| 5:3FTCA | 600 | 690 | | 1 | 115 | 40-150 | 02/28/2024 2012 |
| HFPO-DA | 96 | 110 | | 1 | 116 | 40-150 | 02/28/2024 2012 |
| NEtFOSA | 24 | 23 | | 1 | 94 | 40-150 | 02/28/2024 2012 |
| NEtFOSAA | 24 | 23 | | 1 | 97 | 40-150 | 02/28/2024 2012 |
| NEtFOSE | 240 | 240 | | 1 | 98 | 40-150 | 02/28/2024 2012 |
| NMeFOSA | 24 | 23 | | 1 | 95 | 40-150 | 02/28/2024 2012 |
| NMeFOSAA | 24 | 25 | | 1 | 102 | 40-150 | 02/28/2024 2012 |
| NMeFOSE | 240 | 230 | | 1 | 97 | 40-150 | 02/28/2024 2012 |
| NFDHA | 48 | 51 | | 1 | 106 | 40-150 | 02/28/2024 2012 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 46 | | 1 | 108 | 40-150 | 02/28/2024 2012 |
| PFMPA | 48 | 50 | | 1 | 104 | 40-150 | 02/28/2024 2012 |
| PFMBA | 48 | 51 | | 1 | 106 | 40-150 | 02/28/2024 2012 |
| PFBS | 21 | 20 | | 1 | 96 | 40-150 | 02/28/2024 2012 |
| PFBA | 96 | 93 | | 1 | 96 | 40-150 | 02/28/2024 2012 |
| PFDS | 23 | 21 | | 1 | 91 | 40-150 | 02/28/2024 2012 |
| PFDA | 24 | 24 | | 1 | 100 | 40-150 | 02/28/2024 2012 |
| PFDoS | 23 | 21 | | 1 | 91 | 40-150 | 02/28/2024 2012 |
| PFDoA | 24 | 22 | | 1 | 94 | 40-150 | 02/28/2024 2012 |
| PFHpS | 23 | 22 | | 1 | 95 | 40-150 | 02/28/2024 2012 |
| PFHpA | 24 | 22 | | 1 | 93 | 40-150 | 02/28/2024 2012 |
| 7:3FTCA | 600 | 650 | | 1 | 108 | 40-150 | 02/28/2024 2012 |
| PFHxS | 22 | 20 | | 1 | 89 | 40-150 | 02/28/2024 2012 |
| PFHxA | 24 | 24 | | 1 | 99 | 40-150 | 02/28/2024 2012 |
| PFNS | 23 | 22 | | 1 | 94 | 40-150 | 02/28/2024 2012 |
| PFNA | 24 | 25 | | 1 | 105 | 40-150 | 02/28/2024 2012 |
| PFOSA | 24 | 23 | M-03 | 1 | 97 | 40-150 | 02/28/2024 2012 |
| PFOS | 22 | 22 | M-03 | 1 | 101 | 40-150 | 02/28/2024 2012 |
| PFOA | 24 | 24 | | 1 | 99 | 40-150 | 02/28/2024 2012 |
| PFPeS | 23 | 22 | | 1 | 95 | 40-150 | 02/28/2024 2012 |
| PFPeA | 48 | 46 | | 1 | 97 | 40-150 | 02/28/2024 2012 |
| 3:3FTCA | 120 | 120 | | 1 | 103 | 40-150 | 02/28/2024 2012 |
| PFTeDA | 24 | 23 | | 1 | 95 | 40-150 | 02/28/2024 2012 |
| PFTrDA | 24 | 22 | | 1 | 92 | 40-150 | 02/28/2024 2012 |
| PFUnA | 24 | 22 | | 1 | 93 | 40-150 | 02/28/2024 2012 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 83 | 20-150 |
| 13C2-6:2FTS | | 84 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97343-002
Batch: 97343
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/27/2024 1815

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 79 | 20-150 |
| 13C2-PFDoA | | 88 | 20-150 |
| 13C2-PFTeDA | | 87 | 20-150 |
| 13C3-HFPO-DA | | 92 | 20-150 |
| 13C3-PFBS | | 85 | 20-150 |
| 13C3-PFHxS | | 88 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 |
| 13C4-PFHpA | | 95 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 |
| 13C5-PFPeA | | 94 | 20-150 |
| 13C6-PFDA | | 85 | 20-150 |
| 13C7-PFUnA | | 88 | 20-150 |
| 13C8-PFOA | | 86 | 20-150 |
| 13C8-PFOS | | 92 | 20-150 |
| 13C8-PFOSA | | 95 | 20-150 |
| 13C9-PFNA | | 89 | 20-150 |
| D3-NMeFOSA | | 70 | 20-150 |
| D3-NMeFOSAA | | 88 | 20-150 |
| D5-NEtFOSA | | 73 | 20-150 |
| D5-NEtFOSAA | | 85 | 20-150 |
| D7-NMeFOSE | | 81 | 20-150 |
| D9-NEtFOSE | | 80 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97343-102
Batch: 97343
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/27/2024 1815

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.8 | | 1 | 103 | 40-150 | 02/28/2024 2021 |
| 9Cl-PF3ONS | 7.5 | 7.9 | | 1 | 105 | 40-150 | 02/28/2024 2021 |
| ADONA | 7.6 | 8.1 | | 1 | 107 | 40-150 | 02/28/2024 2021 |
| 8:2FTS | 7.7 | 8.2 | M-03 | 1 | 107 | 40-150 | 02/28/2024 2021 |
| 4:2FTS | 7.5 | 7.3 | M-03 | 1 | 98 | 40-150 | 02/28/2024 2021 |
| 6:2FTS | 7.6 | 7.1 | | 1 | 93 | 40-150 | 02/28/2024 2021 |
| 5:3FTCA | 50 | 52 | | 1 | 103 | 40-150 | 02/28/2024 2021 |
| HFPO-DA | 8.0 | 6.5 | M-03 | 1 | 81 | 40-150 | 02/28/2024 2021 |
| NEtFOSA | 2.0 | 2.1 | M-03 | 1 | 103 | 40-150 | 02/28/2024 2021 |
| NEtFOSAA | 2.0 | 2.0 | M-03 | 1 | 99 | 40-150 | 02/28/2024 2021 |
| NEtFOSE | 20 | 21 | | 1 | 104 | 40-150 | 02/28/2024 2021 |
| NMeFOSA | 2.0 | 2.2 | | 1 | 112 | 40-150 | 02/28/2024 2021 |
| NMeFOSAA | 2.0 | 2.3 | | 1 | 113 | 40-150 | 02/28/2024 2021 |
| NMeFOSE | 20 | 21 | | 1 | 106 | 40-150 | 02/28/2024 2021 |
| NFDHA | 4.0 | 4.5 | M-03 | 1 | 111 | 40-150 | 02/28/2024 2021 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.6 | | 1 | 101 | 40-150 | 02/28/2024 2021 |
| PFMPA | 4.0 | 4.2 | | 1 | 105 | 40-150 | 02/28/2024 2021 |
| PFMBA | 4.0 | 4.0 | | 1 | 100 | 40-150 | 02/28/2024 2021 |
| PFBS | 1.8 | 1.9 | M-03 | 1 | 105 | 40-150 | 02/28/2024 2021 |
| PFBA | 8.0 | 8.5 | | 1 | 107 | 40-150 | 02/28/2024 2021 |
| PFDS | 1.9 | 2.2 | | 1 | 114 | 40-150 | 02/28/2024 2021 |
| PFDA | 2.0 | 2.2 | M-03 | 1 | 110 | 40-150 | 02/28/2024 2021 |
| PFDoS | 1.9 | 2.2 | | 1 | 116 | 40-150 | 02/28/2024 2021 |
| PFDoA | 2.0 | 2.3 | | 1 | 114 | 40-150 | 02/28/2024 2021 |
| PFHpS | 1.9 | 2.4 | M-03 | 1 | 127 | 40-150 | 02/28/2024 2021 |
| PFHpA | 2.0 | 2.2 | | 1 | 112 | 40-150 | 02/28/2024 2021 |
| 7:3FTCA | 50 | 52 | | 1 | 105 | 40-150 | 02/28/2024 2021 |
| PFHxS | 1.8 | 2.1 | M-03 | 1 | 118 | 40-150 | 02/28/2024 2021 |
| PFHxA | 2.0 | 2.1 | | 1 | 105 | 40-150 | 02/28/2024 2021 |
| PFNS | 1.9 | 2.1 | | 1 | 109 | 40-150 | 02/28/2024 2021 |
| PFNA | 2.0 | 2.3 | M-03 | 1 | 115 | 40-150 | 02/28/2024 2021 |
| PFOSA | 2.0 | 2.3 | | 1 | 114 | 40-150 | 02/28/2024 2021 |
| PFOS | 1.9 | 2.1 | M-03 | 1 | 113 | 40-150 | 02/28/2024 2021 |
| PFOA | 2.0 | 2.3 | M-03 | 1 | 117 | 40-150 | 02/28/2024 2021 |
| PFPeS | 1.9 | 1.9 | M-03 | 1 | 100 | 40-150 | 02/28/2024 2021 |
| PFPeA | 4.0 | 4.2 | | 1 | 106 | 40-150 | 02/28/2024 2021 |
| 3:3FTCA | 10 | 10 | | 1 | 104 | 40-150 | 02/28/2024 2021 |
| PFTeDA | 2.0 | 1.8 | | 1 | 90 | 40-150 | 02/28/2024 2021 |
| PFTrDA | 2.0 | 2.0 | M-03 | 1 | 101 | 40-150 | 02/28/2024 2021 |
| PFUnA | 2.0 | 2.0 | | 1 | 101 | 40-150 | 02/28/2024 2021 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 104 | 20-150 |
| 13C2-6:2FTS | | 98 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ97343-102
Batch: 97343
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/27/2024 1815

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 91 | 20-150 |
| 13C2-PFDoA | | 91 | 20-150 |
| 13C2-PFTeDA | | 89 | 20-150 |
| 13C3-HFPO-DA | | 102 | 20-150 |
| 13C3-PFBS | | 101 | 20-150 |
| 13C3-PFHxS | | 102 | 20-150 |
| 13C4-PFBA | | 97 | 20-150 |
| 13C4-PFHpA | | 96 | 20-150 |
| 13C5-PFHxA | | 99 | 20-150 |
| 13C5-PFPeA | | 103 | 20-150 |
| 13C6-PFDA | | 93 | 20-150 |
| 13C7-PFUnA | | 90 | 20-150 |
| 13C8-PFOA | | 97 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 |
| 13C8-PFOSA | | 100 | 20-150 |
| 13C9-PFNA | | 95 | 20-150 |
| D3-NMeFOSA | | 71 | 20-150 |
| D3-NMeFOSAA | | 98 | 20-150 |
| D5-NEtFOSA | | 77 | 20-150 |
| D5-NEtFOSAA | | 88 | 20-150 |
| D7-NMeFOSE | | 86 | 20-150 |
| D9-NEtFOSE | | 86 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZA29006-022MS
Batch: 97343
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/27/2024 1815

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 1800 | 1900 | | 1 | 105 | 40-150 | 02/28/2024 2048 |
| 9Cl-PF3ONS | ND | 1800 | 2100 | | 1 | 115 | 40-150 | 02/28/2024 2048 |
| ADONA | ND | 1800 | 2000 | | 1 | 112 | 40-150 | 02/28/2024 2048 |
| 8:2FTS | ND | 1800 | 1800 | | 1 | 98 | 40-150 | 02/28/2024 2048 |
| 4:2FTS | ND | 1800 | 1800 | | 1 | 101 | 40-150 | 02/28/2024 2048 |
| 6:2FTS | ND | 1800 | 1600 | | 1 | 88 | 40-150 | 02/28/2024 2048 |
| 5:3FTCA | ND | 12000 | 12000 | | 1 | 103 | 40-150 | 02/28/2024 2048 |
| HFPO-DA | ND | 1900 | 2000 | | 1 | 105 | 40-150 | 02/28/2024 2048 |
| NEtFOSA | ND | 480 | 450 | | 1 | 93 | 40-150 | 02/28/2024 2048 |
| NEtFOSAA | ND | 480 | 460 | | 1 | 96 | 40-150 | 02/28/2024 2048 |
| NEtFOSE | ND | 4800 | 4600 | | 1 | 96 | 40-150 | 02/28/2024 2048 |
| NMeFOSA | ND | 480 | 440 | | 1 | 92 | 40-150 | 02/28/2024 2048 |
| NMeFOSAA | ND | 480 | 480 | | 1 | 100 | 40-150 | 02/28/2024 2048 |
| NMeFOSE | ND | 4800 | 4700 | | 1 | 97 | 40-150 | 02/28/2024 2048 |
| NFDHA | ND | 960 | 1000 | | 1 | 108 | 40-150 | 02/28/2024 2048 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 850 | 940 | | 1 | 110 | 40-150 | 02/28/2024 2048 |
| PFMPA | ND | 960 | 990 | | 1 | 103 | 40-150 | 02/28/2024 2048 |
| PFMBA | ND | 960 | 980 | | 1 | 102 | 40-150 | 02/28/2024 2048 |
| PFBS | 62 | 430 | 460 | | 1 | 95 | 40-150 | 02/28/2024 2048 |
| PFBA | 18 | 1900 | 1900 | | 1 | 96 | 40-150 | 02/28/2024 2048 |
| PFDS | ND | 460 | 400 | | 1 | 86 | 40-150 | 02/28/2024 2048 |
| PFDA | ND | 480 | 420 | | 1 | 88 | 40-150 | 02/28/2024 2048 |
| PFDoS | ND | 470 | 420 | | 1 | 90 | 40-150 | 02/28/2024 2048 |
| PFDoA | ND | 480 | 430 | | 1 | 90 | 40-150 | 02/28/2024 2048 |
| PFHpS | 85 | 460 | 510 | | 1 | 93 | 40-150 | 02/28/2024 2048 |
| PFHpA | 27 | 480 | 460 | | 1 | 91 | 40-150 | 02/28/2024 2048 |
| 7:3FTCA | ND | 12000 | 12000 | | 1 | 99 | 40-150 | 02/28/2024 2048 |
| PFHxS | 1100 | 440 | 1400 | | 1 | 74 | 40-150 | 02/28/2024 2048 |
| PFHxA | 64 | 480 | 530 | | 1 | 97 | 40-150 | 02/28/2024 2048 |
| PFNS | ND | 460 | 420 | | 1 | 92 | 40-150 | 02/28/2024 2048 |
| PFNA | 14 | 480 | 440 | | 1 | 89 | 40-150 | 02/28/2024 2048 |
| PFOSA | ND | 480 | 470 | | 1 | 98 | 40-150 | 02/28/2024 2048 |
| PFOS | 9600 | 450 | 8800 | NM-08 | 1 | -169 | 40-150 | 02/28/2024 2048 |
| PFOA | 74 | 480 | 530 | | 1 | 95 | 40-150 | 02/28/2024 2048 |
| PFPeS | 32 | 450 | 470 | | 1 | 97 | 40-150 | 02/28/2024 2048 |
| PFPeA | ND | 960 | 930 | | 1 | 97 | 40-150 | 02/28/2024 2048 |
| 3:3FTCA | ND | 2400 | 2400 | | 1 | 99 | 40-150 | 02/28/2024 2048 |
| PFTeDA | ND | 480 | 470 | | 1 | 98 | 40-150 | 02/28/2024 2048 |
| PFTrDA | ND | 480 | 430 | | 1 | 90 | 40-150 | 02/28/2024 2048 |
| PFUnA | ND | 480 | 490 | | 1 | 103 | 40-150 | 02/28/2024 2048 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 76 | 20-150 |
| 13C2-6:2FTS | M-08 | 76 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZA29006-022MS
Batch: 97343
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/27/2024 1815

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 71 | 20-150 |
| 13C2-PFDoA | | 67 | 20-150 |
| 13C2-PFTeDA | | 61 | 20-150 |
| 13C3-HFPO-DA | | 77 | 20-150 |
| 13C3-PFBS | | 73 | 20-150 |
| 13C3-PFHxS | | 74 | 20-150 |
| 13C4-PFBA | | 76 | 20-150 |
| 13C4-PFHpA | | 74 | 20-150 |
| 13C5-PFHxA | | 75 | 20-150 |
| 13C5-PFPeA | | 81 | 20-150 |
| 13C6-PFDA | | 69 | 20-150 |
| 13C7-PFUnA | | 62 | 20-150 |
| 13C8-PFOA | | 72 | 20-150 |
| 13C8-PFOS | | 74 | 20-150 |
| 13C8-PFOSA | M-08 | 76 | 20-150 |
| 13C9-PFNA | | 77 | 20-150 |
| D3-NMeFOSA | | 55 | 20-150 |
| D3-NMeFOSAA | | 63 | 20-150 |
| D5-NEtFOSA | | 53 | 20-150 |
| D5-NEtFOSAA | | 62 | 20-150 |
| D7-NMeFOSE | | 61 | 20-150 |
| D9-NEtFOSE | | 61 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: ZA29006-022MD
Batch: 97343
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/27/2024 1815

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 1800 | 1900 | | 1 | 107 | 2.4 | 40-150 | 30 | 02/28/2024 2058 |
| 9Cl-PF3ONS | ND | 1800 | 2100 | | 1 | 118 | 2.5 | 40-150 | 30 | 02/28/2024 2058 |
| ADONA | ND | 1800 | 2100 | | 1 | 113 | 1.1 | 40-150 | 30 | 02/28/2024 2058 |
| 8:2FTS | ND | 1800 | 1900 | | 1 | 102 | 3.7 | 40-150 | 30 | 02/28/2024 2058 |
| 4:2FTS | ND | 1800 | 1800 | | 1 | 99 | 1.5 | 40-150 | 30 | 02/28/2024 2058 |
| 6:2FTS | ND | 1800 | 1700 | | 1 | 92 | 4.4 | 40-150 | 30 | 02/28/2024 2058 |
| 5:3FTCA | ND | 12000 | 13000 | | 1 | 111 | 7.1 | 40-150 | 30 | 02/28/2024 2058 |
| HFPO-DA | ND | 1900 | 2100 | | 1 | 108 | 2.9 | 40-150 | 30 | 02/28/2024 2058 |
| NEtFOSA | ND | 480 | 430 | | 1 | 90 | 3.2 | 40-150 | 30 | 02/28/2024 2058 |
| NEtFOSAA | ND | 480 | 460 | | 1 | 95 | 0.86 | 40-150 | 30 | 02/28/2024 2058 |
| NEtFOSE | ND | 4800 | 4700 | | 1 | 97 | 0.73 | 40-150 | 30 | 02/28/2024 2058 |
| NMeFOSA | ND | 480 | 480 | | 1 | 101 | 9.7 | 40-150 | 30 | 02/28/2024 2058 |
| NMeFOSAA | ND | 480 | 460 | | 1 | 95 | 4.4 | 40-150 | 30 | 02/28/2024 2058 |
| NMeFOSE | ND | 4800 | 4700 | | 1 | 97 | 0.25 | 40-150 | 30 | 02/28/2024 2058 |
| NFDHA | ND | 960 | 1000 | | 1 | 104 | 4.2 | 40-150 | 30 | 02/28/2024 2058 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 850 | 880 | | 1 | 102 | 6.8 | 40-150 | 30 | 02/28/2024 2058 |
| PFMPA | ND | 960 | 950 | | 1 | 99 | 3.6 | 40-150 | 30 | 02/28/2024 2058 |
| PFMBA | ND | 960 | 980 | | 1 | 102 | 0.75 | 40-150 | 30 | 02/28/2024 2058 |
| PFBS | 62 | 430 | 450 | | 1 | 90 | 4.1 | 40-150 | 30 | 02/28/2024 2058 |
| PFBA | 18 | 1900 | 1800 | | 1 | 94 | 1.5 | 40-150 | 30 | 02/28/2024 2058 |
| PFDS | ND | 460 | 440 | | 1 | 95 | 9.4 | 40-150 | 30 | 02/28/2024 2058 |
| PFDA | ND | 480 | 470 | | 1 | 98 | 10 | 40-150 | 30 | 02/28/2024 2058 |
| PFDoS | ND | 470 | 440 | | 1 | 94 | 5.0 | 40-150 | 30 | 02/28/2024 2058 |
| PFDoA | ND | 480 | 450 | | 1 | 93 | 3.4 | 40-150 | 30 | 02/28/2024 2058 |
| PFHpS | 85 | 460 | 530 | | 1 | 97 | 2.9 | 40-150 | 30 | 02/28/2024 2058 |
| PFHpA | 27 | 480 | 470 | | 1 | 93 | 2.3 | 40-150 | 30 | 02/28/2024 2058 |
| 7:3FTCA | ND | 12000 | 13000 | | 1 | 104 | 5.6 | 40-150 | 30 | 02/28/2024 2058 |
| PFHxS | 1100 | 440 | 1400 | | 1 | 68 | 1.9 | 40-150 | 30 | 02/28/2024 2058 |
| PFHxA | 64 | 480 | 500 | | 1 | 91 | 5.4 | 40-150 | 30 | 02/28/2024 2058 |
| PFNS | ND | 460 | 460 | | 1 | 100 | 8.9 | 40-150 | 30 | 02/28/2024 2058 |
| PFNA | 14 | 480 | 450 | | 1 | 91 | 1.2 | 40-150 | 30 | 02/28/2024 2058 |
| PFOSA | ND | 480 | 460 | M-08 | 1 | 95 | 3.1 | 40-150 | 30 | 02/28/2024 2058 |
| PFOS | 9600 | 450 | 8800 | NM-08 | 1 | -173 | 0.23 | 40-150 | 30 | 02/28/2024 2058 |
| PFOA | 74 | 480 | 550 | M-08 | 1 | 100 | 5.0 | 40-150 | 30 | 02/28/2024 2058 |
| PFPeS | 32 | 450 | 450 | | 1 | 92 | 4.3 | 40-150 | 30 | 02/28/2024 2058 |
| PFPeA | ND | 960 | 910 | | 1 | 95 | 2.2 | 40-150 | 30 | 02/28/2024 2058 |
| 3:3FTCA | ND | 2400 | 2400 | | 1 | 101 | 1.7 | 40-150 | 30 | 02/28/2024 2058 |
| PFTeDA | ND | 480 | 480 | | 1 | 100 | 1.7 | 40-150 | 30 | 02/28/2024 2058 |
| PFTrDA | ND | 480 | 460 | | 1 | 95 | 5.4 | 40-150 | 30 | 02/28/2024 2058 |
| PFUnA | ND | 480 | 440 | | 1 | 91 | 12 | 40-150 | 30 | 02/28/2024 2058 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 89 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MSD

Sample ID: ZA29006-022MD
Batch: 97343
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 02/27/2024 1815

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 79 | 20-150 |
| 13C2-PFDoA | | 85 | 20-150 |
| 13C2-PFTeDA | | 85 | 20-150 |
| 13C3-HFPO-DA | | 92 | 20-150 |
| 13C3-PFBS | | 89 | 20-150 |
| 13C3-PFHxS | | 91 | 20-150 |
| 13C4-PFBA | | 92 | 20-150 |
| 13C4-PFHpA | | 89 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 |
| 13C5-PFPeA | | 94 | 20-150 |
| 13C6-PFDA | | 87 | 20-150 |
| 13C7-PFUnA | | 86 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 |
| 13C8-PFOS | | 90 | 20-150 |
| 13C8-PFOSA | | 99 | 20-150 |
| 13C9-PFNA | | 89 | 20-150 |
| D3-NMeFOSA | | 70 | 20-150 |
| D3-NMeFOSAA | | 89 | 20-150 |
| D5-NEtFOSA | | 74 | 20-150 |
| D5-NEtFOSAA | | 79 | 20-150 |
| D7-NMeFOSE | | 79 | 20-150 |
| D9-NEtFOSE | | 77 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 142514

| | | |
|---|---|---|
| Client: Arcadis | Report to Contact: Cameron Stewart | Telephone No. / Email: Cameron.Stewart@arcadis.com Jesse.Wright@arcadis.com |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x Austin Westhuis | Quote No. |
| City: Novi / State: MI / Zip Code: 48377 | Printed Name: Austin Westhuis | Analysis (Attach list if more space is needed) |
| Project Name: ESTCP Vertebrae | | Page 1 of 4 |
| Project No.: 30027244.000004 | P.O. No. | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab / Composite | Matrix: Aqueous | Solid | Wipe/Assay | No. of Containers by Preservative Type: Unpres. | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | Field Filtered | PFAS - 1633 | Remarks / Cooler I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMT-VRTB-01_2_01232024 | 1/22/24 | 1535 | G | X | | | 3 | | | | | | | X | |
| CMT-VRTB-01_3_01232024 | 1/22/24 | 1620 | G | X | | | 3 | | | | | | | X | |
| CMT-VRTB-01_4_01232024 | 1/22/24 | 1700 | G | X | | | 3 | | | | | | | X | |
| CMT-VRTB-01_5_01232024 | 1/22/24 | 1735 | G | X | | | 3 | | | | | | | X | |
| CMT-VRTB-01_6_01232024 | 1/22/24 | 1805 | G | X | | | 3 | | | | | | | X | |
| VRTB-D-P8_01232024 | 1/23/24 | 0855 | G | X | | | 3 | | | | | | | X | |
| VRTB-D-R7_01232024 | 1/23/24 | 0950 | G | X | | | 3 | | | | | | | X | |
| VRTB-D-06_01232024 | 1/23/24 | 1040 | G | X | | | 3 | | | | | | | X | |
| VRTB-D-M5_01232024 | 1/23/24 | 1130 | G | X | | | 3 | | | | | | | X | |
| VRTB-S-G4_01232024 | 1/23/24 | 1255 | G | X | | | 3 | | | | | | | X | |

ZA29006

KES

Turn Around Time Required (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client X Disposal by Lab

Possible Hazard Identification: X Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | 1/24/24 | | 1. Received by: FedEx | | |
| 2. Relinquished by | Date | Time | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: FedEx | 01/24 | 0905 | 4. Laboratory received by: Whitney Spencer | 01/24 | 0905 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on ice (Circle): Yes No Ice Pack
Receipt Temp: 1.2 °C
Temp Blank: ☐ Y X N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

★ Level II Package Required ★

Document Number: ME003N8-01

Pace Analytical

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 142513

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Cameron Stewart | Telephone No. / E-mail: Cameron.Stewart@arcadis.com Jessi.Wright@arcadis.com | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x Austin Westhuis | Analysis (Attach list if more space is needed) | Page 2 of 4 |
| City: Novi / State: MI / Zip Code: 48377 | Printed Name: Austin Westhuis | | Lot # Bar Code: ZA29006 |
| Project Name: ESTCP Vertebrae | | | |
| Project No.: 30027244.00004 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | G-Grab C-Composite | Matrix: Aqueous | Soils | Non-Aqueous | No of Containers by Preservative Type: Unpres | H2SO4 | HNO3 | HCl | NaOH | Ascorbic Acid | Zinc Acetate | PFAS - 1633 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-S-Y3_01232024 | 1/23/24 | 1410 | G | X | | | 3 | | | | | | | X |
| VRTB-S-S2_01232024 | 1/23/24 | 1510 | G | X | | | 3 | | | | | | | X |
| VRTB-S-B1_01232024 | 1/23/24 | 1610 | G | X | | | 3 | | | | | | | X |
| VRTB-L-BB8_01232024 | 1/23/24 | 1700 | G | X | | | 3 | | | | | | | X |
| VRTB-L-P7_01232024 | 1/23/24 | 1745 | G | X | | | 3 | | | | | | | X |
| VRTB-L-06_01242024 | 1/24/24 | 0910 | G | X | | | 3 | | | | | | | X |
| VRTB-L-M5_01242024 | 1/24/24 | 1005 | G | X | | | 3 | | | | | | | X |
| VRTB-D-G4_01242024 | 1/24/24 | 1135 | G | X | | | 3 | | | | | | | X |
| VRTB-D-Y3_01242024 | 1/24/24 | 1245 | G | X | | | 3 | | | | | | | X |
| VRTB-D-S2_01242024 | 1/24/24 | 1345 | G | X | | | 3 | | | | | | | X |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify)

**Sample Disposal:** ☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification:** ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | Date: 1/24/24 | Time: | 1. Received by: FedEx | Date: | Time: |
| 2. Relinquished by | Date: | Time: | 2. Received by | Date: | Time: |
| 3. Relinquished by | Date: | Time: | 3. Received by | Date: | Time: |
| 4. Relinquished by: FedEx | Date: 01/27/24 | Time: 0915 | 4. Laboratory received by: [illegible] | Date: 01/27/24 | Time: 0915 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on Ice (Circle) Yes No Ice Pack — Receipt Temp. 0.6, 1.2 °C — Temp Blank ☐ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy ★ Level II Package Required ★

Document Number: ME003N2-01

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 142511

| Client | Report to Contact | Telephone No. / E-mail | Quote No. |
|---|---|---|---|
| Arcadis | Cameron Stewart | | |
| **Address** 28550 Cabot Drive, Suite 500 | **Sampler's Signature** x | **Analysis (Attach list if more space is needed)** | Page 3 of 4 |
| **City** Novi / **State** MI / **Zip Code** 48377 | **Printed Name** Austin Westhuis | | Lot # Ser Code |
| **Project Name** ESTCP Vertebrae | | | ZA29006 |

| Project No. 30027244.00004 | P.O. No. | | Grab/Composite | Matrix | | | No of Containers by Preservative Type | | | | | | | PFAS - 1633 | | | | | | | Remarks / Cooler ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | | Aqueous | Solid | Non-Aqueous | Unpres. | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | Ascorbic Acid | | | | | | | | |
| VRTB-D-B1_01242024 | 1/24/24 | 1455 | G | X | | | 3 | | | | | | | X | | | | | | | |
| VRTB-S-P8_01242024 | 1/24/24 | 1535 | G | X | | | 3 | | | | | | | X | | | | | | | |
| VRTB-S-R7_01252024 | 1/25/24 | 0845 | G | X | | | 3 | | | | | | | X | | | | | | | |
| VRTB-S-O6_01252024 | 1/25/24 | 0950 | G | X | | | 3 | | | | | | | X | | | | | | | |
| VRTB-S-M5_01252024 | 1/25/24 | 1035 | G | X | | | 3 | | | | | | | X | | | | | | | |
| VRTB-L-G4_01252024 | 1/25/24 | 1125 | G | X | | | 3 | | | | | | | X | | | | | | | |
| VRTB-L-Y3_01252024 | 1/25/24 | 1220 | G | X | | | 3 | | | | | | | X | | | | | | | |
| VRTB-L-S2_01252024 | 1/25/24 | 1255 | G | X | | | 9 | | | | | | | X | | | | | | | MS/MSD |
| VRTB-L-B1_01252024 | 1/25/24 | 1405 | G | X | | | 3 | | | | | | | X | | | | | | | |
| DUP-01_01252024 | 1/25/24 | — | G | X | | | 3 | | | | | | | X | | | | | | | |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.)
☒ Standard ☐ Rush (Specify)

**Sample Disposal**
☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification**
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | Relinquished by | Date | Time | Received by | Date | Time |
|---|---|---|---|---|---|---|
| 1. | Austin Westhuis / Arcadis | 1/24/24 | | FedEx | | |
| 2. | | | | | | |
| 3. | | | | | | |
| 4. | FedEx | 1/27/24 | 0915 | [illegible] | 01/27/24 | 0915 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle) Yes No Ice Pack
Receipt Temp. 6.7, 6.8 °C
Temp Blank ☐ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

* Level II Package Required *

Document Number: ME003N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 142512

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Cameron Stewart | Telephone No. / E-mail: | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x | Analysis (Attach list if more space is needed): PFAS - 1633 | Page 4 of 4 |
| City: Novi / State: MI / Zip Code: 48377 | Printed Name: Austin Westhuis | | Lot # Bar Code: ZA29006 |
| Project Name: ESTCP Vertebrae | | | Key: Remarks: |

| Project No. | P.O. No. | Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | G=Grab C=Composite | Matrix: Aqueous | Matrix: Solid | Matrix: Other | No of Containers by Preservative Type: Unpres. | HNO3 | H2SO4 | NaOH | NaOH+Zn | Trizma | Field Filtered |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30027244.00004 | | DUP-02_01252024 | 1/25/24 | — | G | X | | | 3 | | | | | | X |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify)

**Sample Disposal**: ☐ Return to Client X Disposal by Lab

**Possible Hazard Identification**: X Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | | | | | |
|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | Date: 1/26/24 | Time: | 1. Received by: FedEx. | Date: | Time: |
| 2. Relinquished by | Date: | Time: | 2. Received by | Date: | Time: |
| 3. Relinquished by | Date: | Time: | 3. Received by | Date: | Time: |
| 4. Relinquished by: FedEx | Date: 01/27/24 | Time: 0915 | 4. Laboratory Received by: [illegible] | Date: 01/27/24 | Time: 0915 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on Ice (Circle): (Yes) No Ice Pack — Receipt Temp: 0.K °C — Temp Blank ☐ Y ☑ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

★ Level II Package Required ★

Document Number: ME003N2-01



PACE ANALYTICAL SERVICES, LLC

DC#_Title: ENV-FRM-WCOL-0286 v02_Samples Receipt Checklist (SRC)
Effective Date: 8/2/2022

ZA29006

# Sample Receipt Checklist (SRC)

Client: NCLADIS Cooler Inspected by/date: 967 / 07/29/24 LJ

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

| | | |
|---|---|---|
| ☑ Yes | ☐ No | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: nA Chlorine Strip ID: nA Tested by: nA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: nA

0.0 / 0.0 °C 0.8 / 0.8 °C 1.2 / 1.2 °C nA / nA °C

Method: ☐ Temperature Blank ☒ Against Bottles IR Gun ID: 8 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | ☐ NA | 3. Were all coolers received at or below 6.0°C? If no, was Project Manager notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☒ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 7. Was collection date & time listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 8. Did all container label information (ID, date, time) agree with the COC? |
| ☒ Yes | ☐ No | | 9. Were tests to be performed listed on the COC? |
| ☒ Yes | ☐ No | | 10. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? _____ |
| ☑ Yes | ☐ No | | 11. Was adequate sample volume available? |
| ☐ Yes | ☒ No | | 12. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☒ Yes | ☐ No | | 13. Were all samples containers accounted for? (No missing/excess) |
| ☐ Yes | ☐ No | ☑ NA | 14. Were VOA, 8015C and RSK-175 samples free of bubbles >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☒ NA | 15. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☒ NA | 16. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☒ NA | 17. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☑ Yes | ☐ No | ☐ NA | 18. Was the quote number listed on the container label? If yes, Quote # 72514 |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) nA were received incorrectly preserved and were adjusted accordingly in sample receiving with nA mL of circle one: $H_2SO_4$, $HNO_3$, HCl, NaOH using SR # nA. ☐

Time of preservation nA. If more than one preservative is needed, please note in the comments below.

Sample(s) nA were received with bubbles >6 mm in diameter.

Samples(s) nA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Unique ID: nA.

Comments:

Qualtrax ID: 56360

# Performance Monitoring Event #7

# Report of Analysis

**Arcadis U.S., Inc.**
9954 Mayland Drive
Richmond, VA 23233
Attention: Jesse Wright

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Lot Number:**ZD05031**

Date Completed:05/15/2024

05/20/2024 9:13 AM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: ZD05031

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.
Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.4 has been followed for these samples, and specifically Table B-24 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples were compliant with DOD QSM 5.4 table B-24 and our PFAS SOP. Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). The CF is calculated as follows:

CF = DF * FV / Vo
FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a DoD/DOE accredited laboratory; however, the following analyses are currently not listed on our DoD/DOE scope of accreditation: Drinking Water: pH EPA 150.1, Turbidity EPA 180.1, Metals EPA 200.7 & 200.8, Mercury EPA 245.1, Anions EPA 300.0, Cyanide EPA 335.4, Nitrates EPA 353.2, Orthophosphate & Phosphorus EPA 365.1, EDB/DBCP EPA 504.1, HPC SIMPLATE, Color SM 2120 B-2011, Alkalinity SM 2320 B-2011, Specific Conductance SM 2510 B-2011, Residue-filterable (TDS) SM 2540 C, Calcium Hardness (CaCO2) SM 3500-Ca B-2011, TRC SM 4500 Cl G-2011, pH SM 4500 H=B-2011, E.Coli, Total Coliform. Non-Potable Water: Metals EPA 200.7, Strontium EPA 200.8, Chlorate EPA

300.0, Cyanide EPA 335.4, Phenolics EPA 420.4, 2-Methyl-4,6-Dinitrophenol EPA 625.1, Propane RSK-175, Specific Conductance SM 2510 B-2011, Salinity SM2520 B, Residue- total SM 2540 B, Sulfite SM 4500 SO32- B-2011, Amenable Cyanide SM 4500-CN- G-2011, BOD & CBOD SM 5210 B, MBAS SM 5540 C-2011, Boron & Titanium SW-846 6010D, Boron, Molybdenum, & Titanium SW-846 6020B, Alcohols & Glycols SW-846 8015C, Pentachlorophenol SW-846 8151A, Ethyl Acetate, Hexane, & n-Hexane SW-846 8260D, SVOC 1,4-Dioxane, 4-Dimethyl aminoazobenzene, 1,4-Naphthoquinone, 3,5-Dinitroaniline, PETN SW-846 8270E, Amenable Cyanide SW-846 9012B. Solid and Chemical Materials: Boron & Titanium SW-846 6010D, Molybdenum SW-846 6020B, Ethylene Glycol SW-846 8015B, Pentachlorophenol SW-846 8151A, Chloroprene SW-846 8260B, SVOC 1,4-Dioxane, 1,3,5-Trinitrobenzene, 1,4- Naphthoquinone, 1,4-Phenylenediamine, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 3-Methylcholanthrene, 4-Aminobiphenyl, 4-Dimethyl aminoazobenzene, 4-Nitroquinoline-1-oxide, 7,12-Dimethylbenzo(a)anthracene, Chlorobenzilate, Diallate, Ethyl methanesulfonate, Isodrin, Isosafrole, Methyl methanesulfonate, n-Nitrosomethylethylamine, n-Nitrosomorpholine, n-Nitrosopiperidine, Piperonyl butoxide, Pronamide, Safrole, 3,5- Dinitroaniline, PETN SW-846 8270E, Oil & Grease SW-846 9071B.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18. If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

PFAS
Reextraction of the following samples was performed outside of the holding time: ZD05031-002, ZD05031-003, ZD05031-027, ZD05031-030. Samples were re-extracted for a dilution and all data has been reported.

Surrogate recovery for the following samples was outside control limits: ZD05031-006, ZD05031-007, ZD05031-008. Re-extraction and/or re-analysis was performed outside of holding time with acceptable results and all data has been reported.

The LCS associated with batch 10637 had PFOS recovered above the acceptance limits. Samples ZD05031-009, ZD05031-010, ZD05031-011, ZD05031-012, ZD05031-013, ZD05031-014, ZD05031-015, ZD05031-016, ZD05031-017 were re-extracted and re-analyzed outside of holding time. All data has been reported.

The MS/MSD associated with samples ZD05031-003, ZD05031-027, ZD05031-030 had compounds recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

The method blank associated with batches 10632, 10637, 11501 had PFOS detected at a concentration that was above the MDL but below the PQL. All samples associated with this method blank that have detections for PFOS have been flagged with a "B”.

The method blank associated with batch 11072 had PFHxS, PFOS detected at a concentration that was above the MDL but below the PQL. All samples associated with this method blank that have detections for PFHxS, PFOS have been flagged with a "B”.

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-001 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-001 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-001 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-001 | 1 | D5-NEtFOSA | M-03 |
| 1633 | ZD05031-002 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-002 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-002 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-002 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-002 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-002 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-002 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-002 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-002 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-002 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-002 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZD05031-002 | 1 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-002 | 1 | 13C8-PFOSA | M-03 |
| 1633 | ZD05031-002 | 1 | D3-NMeFOSAA | M-03 |
| 1633 | ZD05031-002 | 1 | D5-NEtFOSA | M-03 |
| 1633 | ZD05031-002 | 1 | D7-NMeFOSE | M-03 |
| 1633 | ZD05031-002 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-002 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-002 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-002 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-002 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-002 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-002 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-002 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-002 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-002 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-002 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-002 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-002 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-003 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-003 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-003 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-003 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-003 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-003 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-003 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-003 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-003 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-003 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-003 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-003 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-003 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-003 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-003 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-003 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-003 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-003 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-003 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-004 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-004 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-004 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-004 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-004 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-004 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-004 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-004 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-004 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-004 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZD05031-005 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-005 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-005 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-005 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-005 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-005 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-005 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-005 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-005 | 1 | 13C5-PFPeA | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-005 | 1 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-006 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-006 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-006 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZD05031-006 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-006 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-006 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-006 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-006 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-006 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-006 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZD05031-006 | 1 | D5-NEtFOSAA | M-03 |
| 1633 | ZD05031-006 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-006 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-006 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-006 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-006 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-006 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-006 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-006 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-006 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-006 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-006 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZD05031-006 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-006 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-006 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZD05031-006 | 2 | 13C3-PFHxS | M-03 |
| 1633 | ZD05031-006 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZD05031-006 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZD05031-006 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZD05031-006 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZD05031-006 | 3 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-006 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-006 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-006 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-006 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-006 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-006 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-006 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-006 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-006 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-007 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-007 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-007 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-007 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZD05031-007 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-007 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-007 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-007 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-007 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-007 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-007 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-007 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-007 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-007 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-007 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-007 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-007 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-007 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-007 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-007 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-007 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-007 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-007 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZD05031-007 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZD05031-007 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-007 | 2 | 13C8-PFOA | M-03 |
| 1633 | ZD05031-007 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZD05031-007 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZD05031-007 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZD05031-007 | 2 | D7-NMeFOSE | M-03 |
| 1633 | ZD05031-007 | 3 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-007 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-007 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-007 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-007 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-007 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-007 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-007 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-007 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-007 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-007 | 3 | 13C7-PFUnA | M-03 |
| 1633 | ZD05031-008 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-008 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-008 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-008 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-008 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-008 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-008 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-008 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-008 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-008 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZD05031-008 | 1 | 13C2-4:2FTS | M-03 |
| 1633 | ZD05031-008 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-008 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-008 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-008 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-008 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-008 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-008 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-008 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-008 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-008 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-008 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-008 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-008 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZD05031-008 | 2 | D3-NMeFOSA | M-03 |
| 1633 | ZD05031-008 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZD05031-008 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-008 | 3 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-008 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-008 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-008 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-008 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-008 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-008 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-008 | 3 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-008 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-008 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-008 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-008 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-009 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-009 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-009 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-009 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-009 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-009 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-009 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-009 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZD05031-009 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-009 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-009 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-009 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-009 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-009 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-009 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-009 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZD05031-009 | 2 | 13C5-PFHxA | M-03 |
| 1633 | ZD05031-009 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-009 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZD05031-009 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZD05031-009 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZD05031-009 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZD05031-009 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-009 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-009 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-009 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-009 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-009 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-009 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-009 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-010 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-010 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-010 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-010 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-010 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-010 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-010 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-010 | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZD05031-010 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-010 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-010 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-010 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-010 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-010 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-010 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-010 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-010 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-010 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZD05031-010 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZD05031-010 | 2 | 13C3-PFBS | M-03 |
| 1633 | ZD05031-010 | 2 | 13C4-PFHpA | M-03 |
| 1633 | ZD05031-010 | 2 | 13C5-PFHxA | M-03 |
| 1633 | ZD05031-010 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZD05031-010 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZD05031-010 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZD05031-010 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-010 | 3 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-010 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-010 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-010 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-010 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-010 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-010 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-010 | 3 | Perfluorononanoic acid (PFNA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-010 | 3 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-010 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-010 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-010 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-011 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-011 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-011 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZD05031-011 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-011 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-011 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZD05031-011 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-011 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-011 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-011 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-011 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-011 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-011 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-011 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-011 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-011 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-011 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-011 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-011 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-011 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-011 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-011 | 2 | 13C4-PFHpA | M-03 |
| 1633 | ZD05031-011 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-011 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-011 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-011 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-011 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-011 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-011 | 3 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-011 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-011 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-011 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-011 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-012 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZD05031-012 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZD05031-012 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-012 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-012 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-012 | 1 | D5-NEtFOSAA | M-03 |
| 1633 | ZD05031-012 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-012 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-012 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-012 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-012 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-012 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-012 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-012 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-012 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-012 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZD05031-012 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-012 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-012 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZD05031-012 | 2 | 13C3-PFHxS | M-03 |
| 1633 | ZD05031-012 | 2 | 13C4-PFHpA | M-03 |
| 1633 | ZD05031-012 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZD05031-012 | 2 | 13C8-PFOA | M-03 |
| 1633 | ZD05031-012 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZD05031-012 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZD05031-012 | 2 | D3-NMeFOSA | M-03 |
| 1633 | ZD05031-012 | 2 | D5-NEtFOSA | M-03 |
| 1633 | ZD05031-012 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZD05031-012 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-012 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-012 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-012 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-012 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-012 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-012 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-012 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-012 | 3 | Perfluorooctanesulfonamide (PFOSA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-012 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-012 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-012 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-012 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-013 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-013 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-013 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-013 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-013 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-013 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-013 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-013 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-013 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-013 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-013 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-013 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-013 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-013 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-013 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-013 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZD05031-013 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZD05031-013 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZD05031-013 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-013 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-013 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-013 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-013 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-013 | 3 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-013 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-013 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-013 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-013 | 3 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-014 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-014 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-014 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-014 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-014 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-014 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-014 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-014 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-014 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZD05031-014 | 1 | D3-NMeFOSAA | M-03 |
| 1633 | ZD05031-014 | 1 | D5-NEtFOSAA | M-03 |
| 1633 | ZD05031-014 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-014 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-014 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-014 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-014 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-014 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-014 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-014 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-014 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZD05031-014 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZD05031-014 | 3 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-014 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-014 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-014 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-014 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-014 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-014 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-014 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-014 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-014 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-014 | 3 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-015 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-015 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-015 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-015 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-015 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-015 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-015 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-015 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-015 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-015 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-015 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-015 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-015 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-015 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-015 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-015 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-015 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-015 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-016 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-016 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-016 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-016 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-016 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-016 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-016 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-016 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-016 | 1 | D3-NMeFOSA | M-03 |
| 1633 | ZD05031-016 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-016 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-016 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-016 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-016 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-016 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-016 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-016 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-016 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-017 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-017 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-017 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-017 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-017 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-017 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-017 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-017 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-017 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-017 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-017 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-017 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-017 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-017 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-017 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-017 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-017 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-018 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-018 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-018 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-018 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-018 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-018 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-018 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-018 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-018 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-018 | 1 | 13C2-4:2FTS | M-03 |
| 1633 | ZD05031-018 | 1 | 13C9-PFNA | M-03 |
| 1633 | ZD05031-019 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-019 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-019 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-019 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-019 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-019 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-019 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-019 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-019 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-020 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-020 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-020 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-020 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-020 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-020 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-020 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-020 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZD05031-020 | 1 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-021 | 1 | Perfluoro-3-methoxypropanoic acid | M-03 |
| 1633 | ZD05031-021 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-021 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-021 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-021 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-021 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-021 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZD05031-022 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-022 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-022 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-022 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-022 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-022 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-022 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-023 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-023 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-023 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZD05031-023 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-023 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-023 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-023 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-023 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZD05031-024 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-024 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-024 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-024 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-024 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-024 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-024 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-024 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-024 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-025 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-025 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-025 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-025 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-025 | 1 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-025 | 2 | 13C3-PFHxS | M-03 |
| 1633 | ZD05031-025 | 2 | 13C8-PFOA | M-03 |
| 1633 | ZD05031-025 | 2 | 13C9-PFNA | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-026 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-026 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-026 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-026 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-026 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-026 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-026 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-026 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-026 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZD05031-027 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-027 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-027 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-027 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-027 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-027 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-027 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-027 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-027 | 1 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-027 | 1 | 13C9-PFNA | M-03 |
| 1633 | ZD05031-027 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-027 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-027 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-027 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-027 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-027 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-027 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-027 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-027 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-027 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-028 | 1 | Perfluoro-3-methoxypropanoic acid | M-03 |
| 1633 | ZD05031-028 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-028 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-028 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-028 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZD05031-028 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-028 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-028 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-028 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-028 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-028 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-028 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-028 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-028 | 2 | 13C3-PFBS | M-03 |
| 1633 | ZD05031-028 | 2 | 13C3-PFHxS | M-03 |
| 1633 | ZD05031-028 | 1 | 13C9-PFNA | M-03 |
| 1633 | ZD05031-028 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZD05031-028 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZD05031-028 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZD05031-029 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-029 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-029 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-029 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-029 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-029 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZD05031-029 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-029 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-029 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-029 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZD05031-029 | 2 | 13C4-PFHpA | M-03 |
| 1633 | ZD05031-029 | 2 | 13C5-PFHxA | M-03 |
| 1633 | ZD05031-029 | 1 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-029 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-029 | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZD05031-029 | 2 | 13C8-PFOSA | M-03 |
| 1633 | ZD05031-029 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZD05031-029 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZD05031-030 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-030 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-030 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-030 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-030 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-030 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-030 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-030 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-030 | 1 | 13C2-4:2FTS | M-03 |
| 1633 | ZD05031-030 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-030 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZD05031-030 | 1 | 13C3-PFBS | M-03 |
| 1633 | ZD05031-030 | 1 | 13C3-PFHxS | M-03 |
| 1633 | ZD05031-030 | 1 | 13C4-PFHpA | M-03 |
| 1633 | ZD05031-030 | 1 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-030 | 1 | 13C8-PFOA | M-03 |
| 1633 | ZD05031-030 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZD05031-030 | 1 | 13C9-PFNA | M-03 |
| 1633 | ZD05031-030 | 1 | D3-NMeFOSAA | M-03 |
| 1633 | ZD05031-030 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-030 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-030 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-030 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-030 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-030 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZD05031-030 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-031 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZD05031-031 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-031 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZD05031-031 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-031 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-031 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-031 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-031 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-031 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZD05031-031 | 1 | 13C2-4:2FTS | M-03 |
| 1633 | ZD05031-031 | 1 | 13C2-6:2FTS | M-03 |
| 1633 | ZD05031-031 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZD05031-031 | 1 | 13C2-PFDoA | M-03 |
| 1633 | ZD05031-031 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZD05031-031 | 1 | 13C3-PFBS | M-03 |
| 1633 | ZD05031-031 | 1 | 13C5-PFHxA | M-03 |
| 1633 | ZD05031-031 | 1 | 13C6-PFDA | M-03 |
| 1633 | ZD05031-031 | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZD05031-031 | 1 | 13C8-PFOSA | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-031 | 1 | 13C9-PFNA | M-03 |
| 1633 | ZD05031-003MS | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ10620-102 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZQ10620-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | ZQ10620-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ10620-102 | 1 | N-ethyl | M-03 |
| 1633 | ZD05031-003MS | 1 | N-ethyl | M-03 |
| 1633 | ZQ10620-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ10620-102 | 1 | N-methyl | M-03 |
| 1633 | ZD05031-003MS | 1 | N-methyl | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluoro-4-methoxybutanoic acid | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluorododecanesulfonic acid (PFDoS) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-003MS | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ10620-002 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-003MS | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ10620-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-003MS | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-003MS | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ10620-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ10620-102 | 1 | 13C6-PFDA | M-03 |
| 1633 | ZQ11072-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ11072-102 | 1 | 1H,1H,2H,2H-Perfluorohexane sulfonic | M-03 |
| 1633 | ZQ11072-102 | 1 | N-ethyl | M-03 |
| 1633 | ZD05031-027MS | 2 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ11072-002 | 1 | N-methyl | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ11072-102 | 1 | N-methyl | M-03 |
| 1633 | ZD05031-027MS | 2 | N-methyl | M-03 |
| 1633 | ZQ11072-102 | 1 | Nonafluoro-3,6-dioxaheptanoic acid | M-03 |
| 1633 | ZD05031-027DU | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-027DU | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZD05031-027DU | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZD05031-027DU | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZQ11072-001 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-027DU | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ11072-002 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-027DU | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-027MS | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ11072-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ11072-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-027DU | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-027MS | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-027MS | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ11072-002 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZQ11072-102 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ11072-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ11072-001 | 1 | 13C2-6:2FTS | M-03 |
| 1633 | ZQ11072-102 | 1 | 13C6-PFDA | M-03 |
| 1633 | ZQ10637-102 | 1 | 11-Chloroeicosafluoro-3-oxaundecane- | M-03 |
| 1633 | ZQ10637-002 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-012DU | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZQ10637-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ10637-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ10637-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ10637-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ10637-102 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ10637-102 | 1 | N-methyl | M-03 |
| 1633 | ZD05031-017MS | 1 | N-methyl | M-03 |
| 1633 | ZQ10637-002 | 1 | Nonafluoro-3,6-dioxaheptanoic acid | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZD05031-012DU | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluorododecanesulfonic acid (PFDoS) | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ10637-002 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-012DU | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZD05031-017MS | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZD05031-012DU | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZD05031-017MS | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-012DU | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ10637-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ10637-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-012DU | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-017MS | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-017MS | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZQ10637-102 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ10637-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZD05031-012DU | 1 | 13C7-PFUnA | M-03 |
| 1633 | ZD05031-012DU | 1 | 13C8-PFOS | M-03 |
| 1633 | ZQ10637-001 | 1 | 13C9-PFNA | M-03 |
| 1633 | ZQ10916-102 | 1 | 2H,2H,3H,3H-Perfluorooctanoic acid | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ10916-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ10916-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ10916-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ10916-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZQ10916-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ10916-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ10916-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ10916-102 | 1 | 3-Perfluoroheptyl propanoic acid | M-03 |
| 1633 | ZQ10916-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ10916-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ10916-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ10916-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ10916-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ10916-102 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZQ10916-102 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ10916-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ10916-001 | 1 | D5-NEtFOSAA | M-03 |
| 1633 | ZQ10632-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ10632-102 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZD05031-027MS | 1 | N-ethyl | M-03 |
| 1633 | ZQ10632-002 | 1 | N-ethyl | M-03 |
| 1633 | ZD05031-027MD | 1 | N-ethyl | M-03 |
| 1633 | ZQ10632-102 | 1 | N-ethyl | M-03 |
| 1633 | ZD05031-027MS | 1 | N-methyl | M-03 |
| 1633 | ZQ10632-002 | 1 | N-methyl | M-03 |
| 1633 | ZD05031-027MD | 1 | N-methyl | M-03 |
| 1633 | ZQ10632-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ10632-001 | 1 | N-methyl | M-03 |
| 1633 | ZQ10632-102 | 1 | Perfluoro(2-ethoxyethane)sulfonic acid | M-03 |
| 1633 | ZQ10632-102 | 1 | Perfluorododecanesulfonic acid (PFDoS) | M-03 |
| 1633 | ZQ10632-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ10632-102 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZQ10632-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-027MD | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZD05031-027MS | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ10632-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ10632-001 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZD05031-027MS | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZD05031-027MD | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ10632-102 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ10632-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-027MS | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ10632-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-027MD | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ10632-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-027MS | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-027MD | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ10632-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-027MD | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZQ10632-102 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ10632-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ10632-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ10632-102 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZQ11501-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | ZQ11501-102 | 1 | N-ethyl | M-03 |
| 1633 | ZD05031-030MS | 3 | N-ethyl | M-03 |
| 1633 | ZQ11501-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ11501-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ11501-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ11501-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ11501-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ11501-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ11501-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ11501-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ11501-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-030MS | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-030MD | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZD05031-030MS | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZD05031-030MD | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ11501-102 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ11501-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | 04/01/2024 1305 | 04/05/2024 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | 04/01/2024 1415 | 04/05/2024 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | 04/01/2024 1515 | 04/05/2024 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | 04/01/2024 1600 | 04/05/2024 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | 04/01/2024 1640 | 04/05/2024 |
| 006 | VRTB-L-M5_04012024 | Aqueous | 04/01/2024 1740 | 04/05/2024 |
| 007 | VRTB-L-06_04012024 | Aqueous | 04/01/2024 1825 | 04/05/2024 |
| 008 | VRTB-L-P7_04012024 | Aqueous | 04/01/2024 1925 | 04/05/2024 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | 04/01/2024 2005 | 04/05/2024 |
| 010 | VRTB-S-M5_04022024 | Aqueous | 04/02/2024 1005 | 04/05/2024 |
| 011 | VRTB-S-06_04022024 | Aqueous | 04/02/2024 1110 | 04/05/2024 |
| 012 | VRTB-S-R7_04022024 | Aqueous | 04/02/2024 1215 | 04/05/2024 |
| 013 | VRTB-S-P8_04022024 | Aqueous | 04/02/2024 1330 | 04/05/2024 |
| 014 | VRTB-D-B1_04022024 | Aqueous | 04/02/2024 1520 | 04/05/2024 |
| 015 | VRTB-D-S2_04022024 | Aqueous | 04/02/2024 1610 | 04/05/2024 |
| 016 | VRTB-D-Y3_04022024 | Aqueous | 04/02/2024 1715 | 04/05/2024 |
| 017 | VRTB-D-G4_04022024 | Aqueous | 04/02/2024 1805 | 04/05/2024 |
| 018 | VRTB-D-M5_04032024 | Aqueous | 04/03/2024 1230 | 04/05/2024 |
| 019 | VRTB-D-06_04032024 | Aqueous | 04/03/2024 1320 | 04/05/2024 |
| 020 | VRTB-D-R7_04032024 | Aqueous | 04/03/2024 1420 | 04/05/2024 |
| 021 | VRTB-D-P8_04032024 | Aqueous | 04/03/2024 1525 | 04/05/2024 |
| 022 | VRTB-S-B1_04032024 | Aqueous | 04/03/2024 1620 | 04/05/2024 |
| 023 | VRTB-S-S2_04032024 | Aqueous | 04/03/2024 1725 | 04/05/2024 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | 04/03/2024 1830 | 04/05/2024 |
| 025 | VRTB-S-G4_04032024 | Aqueous | 04/03/2024 1920 | 04/05/2024 |
| 026 | VRTB-L-B1_04042024 | Aqueous | 04/04/2024 0935 | 04/05/2024 |
| 027 | VRTB-L-S2_04042024 | Aqueous | 04/04/2024 1015 | 04/05/2024 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | 04/04/2024 1105 | 04/05/2024 |
| 029 | VRTB-L-G4_04042024 | Aqueous | 04/04/2024 1145 | 04/05/2024 |
| 030 | DUP-01_04022024 | Aqueous | 04/02/2024 | 04/05/2024 |
| 031 | DUP-02_04042024 | Aqueous | 04/04/2024 | 04/05/2024 |

(31 samples)

## Detection Summary

## Arcadis U.S., Inc.

Lot Number: ZD05031

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | PFBS | 1633 | 55 | | ng/L | 40 |
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | PFBA | 1633 | 16 | J | ng/L | 40 |
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | PFHpS | 1633 | 8.0 | | ng/L | 40 |
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | PFHpA | 1633 | 73 | | ng/L | 40 |
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | PFHxS | 1633 | 50 | M-03 | ng/L | 40 |
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | PFHxA | 1633 | 39 | | ng/L | 40 |
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | PFNA | 1633 | 11 | M-03 | ng/L | 40 |
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | PFOS | 1633 | 1300 | M-03 | ng/L | 40 |
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | PFOA | 1633 | 140 | | ng/L | 40 |
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | PFPeS | 1633 | 1.9 | JM-03 | ng/L | 40 |
| 001 | CMT-VRTB-01_1_04012024 | Aqueous | PFPeA | 1633 | 40 | | ng/L | 40 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | 8:2FTS | 1633 | 28 | JM-03 | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | 6:2FTS | 1633 | 120 | M-03 | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFBS | 1633 | 20 | M-03 | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFBA | 1633 | 41 | | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFHpS | 1633 | 180 | | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFHpA | 1633 | 100 | M-03 | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFHxS | 1633 | 2100 | M-03 | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFHxA | 1633 | 190 | | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFNA | 1633 | 73 | M-03 | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFOSA | 1633 | 1.9 | JM-03 | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFOA | 1633 | 330 | M-03 | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFPeS | 1633 | 46 | M-03 | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFPeA | 1633 | 100 | M-03 | ng/L | 42 |
| 002 | CMT-VRTB-01_2_04012024 | Aqueous | PFOS | 1633 | 30000 | BHM-03 | ng/L | 44 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | 8:2FTS | 1633 | 16 | M-03 | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | 6:2FTS | 1633 | 21 | | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFBS | 1633 | 6.4 | M-03 | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFBA | 1633 | 15 | | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFHpS | 1633 | 48 | | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFHpA | 1633 | 26 | | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFHxS | 1633 | 400 | | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFHxA | 1633 | 27 | | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFNA | 1633 | 28 | M-03 | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFOSA | 1633 | 0.61 | JM-03 | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFOA | 1633 | 63 | M-03 | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFPeS | 1633 | 8.6 | M-03 | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFPeA | 1633 | 26 | | ng/L | 46 |
| 003 | CMT-VRTB-01_3_04012024 | Aqueous | PFOS | 1633 | 5600 | BHM-03 | ng/L | 48 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | 6:2FTS | 1633 | 27 | | ng/L | 50 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | PFBS | 1633 | 7.1 | M-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | PFBA | 1633 | 13 | | ng/L | 50 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | PFHpS | 1633 | 24 | M-03 | ng/L | 50 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | PFHpA | 1633 | 21 | M-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | PFHxS | 1633 | 440 | M-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | PFHxA | 1633 | 24 | | ng/L | 50 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | PFNA | 1633 | 13 | M-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | PFOS | 1633 | 1300 | M-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | PFOA | 1633 | 67 | M-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | PFPeS | 1633 | 10 | M-03 | ng/L | 50 |
| 004 | CMT-VRTB-01_4_04012024 | Aqueous | PFPeA | 1633 | 18 | | ng/L | 50 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | PFBS | 1633 | 7.4 | | ng/L | 52 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | PFBA | 1633 | 9.6 | | ng/L | 52 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | PFHpS | 1633 | 7.5 | M-03 | ng/L | 52 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | PFHpA | 1633 | 9.5 | M-03 | ng/L | 52 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | PFHxS | 1633 | 190 | M-03 | ng/L | 52 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | PFHxA | 1633 | 14 | M-03 | ng/L | 52 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | PFNA | 1633 | 1.8 | M-03 | ng/L | 52 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | PFOS | 1633 | 270 | M-03 | ng/L | 52 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | PFOA | 1633 | 20 | M-03 | ng/L | 52 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | PFPeS | 1633 | 9.2 | | ng/L | 52 |
| 005 | CMT-VRTB-01_5_04012024 | Aqueous | PFPeA | 1633 | 10 | | ng/L | 52 |
| 006 | VRTB-L-M5_04012024 | Aqueous | 8:2FTS | 1633 | 34 | | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | 6:2FTS | 1633 | 83 | | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFBS | 1633 | 5.2 | M-03 | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFBA | 1633 | 30 | M-03 | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFDA | 1633 | 0.25 | JM-03 | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFHpS | 1633 | 64 | | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFHpA | 1633 | 82 | | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFHxA | 1633 | 74 | | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFNA | 1633 | 86 | M-03 | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFOSA | 1633 | 1.0 | M-03 | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFOA | 1633 | 130 | M-03 | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFPeS | 1633 | 13 | M-03 | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFPeA | 1633 | 83 | | ng/L | 54 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFHxS | 1633 | 650 | M-03 | ng/L | 56 |
| 006 | VRTB-L-M5_04012024 | Aqueous | PFOS | 1633 | 11000 | BHM-03 | ng/L | 58 |
| 007 | VRTB-L-06_04012024 | Aqueous | 8:2FTS | 1633 | 55 | | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | 6:2FTS | 1633 | 140 | M-03 | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFBS | 1633 | 5.7 | M-03 | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFBA | 1633 | 46 | M-03 | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFDA | 1633 | 0.42 | JM-03 | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFHpS | 1633 | 99 | | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFHpA | 1633 | 150 | | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFHxA | 1633 | 130 | M-03 | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFNA | 1633 | 110 | M-03 | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFOA | 1633 | 220 | M-03 | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFPeS | 1633 | 20 | M-03 | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFPeA | 1633 | 160 | | ng/L | 60 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFHxS | 1633 | 1100 | M-03 | ng/L | 62 |
| 007 | VRTB-L-06_04012024 | Aqueous | PFOSA | 1633 | 1.4 | JM-03 | ng/L | 62 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 007 | VRTB-L-06_04012024 | Aqueous | PFOS | 1633 | 17000 | BHM-03 | ng/L | 64 |
| 008 | VRTB-L-P7_04012024 | Aqueous | 8:2FTS | 1633 | 37 | | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | 6:2FTS | 1633 | 140 | | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFBS | 1633 | 11 | M-03 | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFBA | 1633 | 57 | M-03 | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFHpS | 1633 | 140 | | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFHpA | 1633 | 190 | | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFHxA | 1633 | 190 | M-03 | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFNA | 1633 | 73 | M-03 | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFOSA | 1633 | 1.9 | M-03 | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFOA | 1633 | 260 | M-03 | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFPeS | 1633 | 39 | M-03 | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFPeA | 1633 | 160 | | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | 3:3FTCA | 1633 | 1.5 | JM-03 | ng/L | 66 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFHxS | 1633 | 1300 | M-03 | ng/L | 68 |
| 008 | VRTB-L-P7_04012024 | Aqueous | PFOS | 1633 | 20000 | BHM-03 | ng/L | 70 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | 8:2FTS | 1633 | 18 | M-03 | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | 6:2FTS | 1633 | 140 | | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFBS | 1633 | 26 | | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFBA | 1633 | 120 | | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFHpS | 1633 | 200 | M-03 | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFHpA | 1633 | 380 | | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFHxA | 1633 | 430 | | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFNA | 1633 | 100 | M-03 | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFOSA | 1633 | 1.4 | M-03 | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFOA | 1633 | 410 | M-03 | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFPeS | 1633 | 91 | | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFPeA | 1633 | 320 | | ng/L | 72 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFHxS | 1633 | 3400 | M-03 | ng/L | 74 |
| 009 | VRTB-L-BB8_04012024 | Aqueous | PFOS | 1633 | 14000 | HM-03 | ng/L | 76 |
| 010 | VRTB-S-M5_04022024 | Aqueous | 8:2FTS | 1633 | 63 | | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | 6:2FTS | 1633 | 86 | | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFBS | 1633 | 6.7 | M-03 | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFBA | 1633 | 27 | | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFHpS | 1633 | 70 | | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFHpA | 1633 | 92 | | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFHxA | 1633 | 87 | M-03 | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFNA | 1633 | 31 | M-03 | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFOSA | 1633 | 0.87 | M-03 | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFOA | 1633 | 140 | M-03 | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFPeS | 1633 | 22 | | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFPeA | 1633 | 65 | | ng/L | 78 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFHxS | 1633 | 790 | M-03 | ng/L | 80 |
| 010 | VRTB-S-M5_04022024 | Aqueous | PFOS | 1633 | 4800 | HM-03 | ng/L | 82 |
| 011 | VRTB-S-06_04022024 | Aqueous | 8:2FTS | 1633 | 1.1 | JM-03 | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | 6:2FTS | 1633 | 6.1 | M-03 | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFBS | 1633 | 14 | | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFBA | 1633 | 14 | | ng/L | 84 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 011 | VRTB-S-06_04022024 | Aqueous | PFDA | 1633 | 0.59 | JM-03 | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFHpS | 1633 | 110 | M-03 | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFHpA | 1633 | 23 | | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFHxA | 1633 | 49 | | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFNS | 1633 | 0.69 | JM-03 | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFNA | 1633 | 8.6 | M-03 | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFOSA | 1633 | 6.3 | M-03 | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFOA | 1633 | 100 | M-03 | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFPeS | 1633 | 44 | M-03 | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFPeA | 1633 | 25 | M-03 | ng/L | 84 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFHxS | 1633 | 1100 | M-03 | ng/L | 86 |
| 011 | VRTB-S-06_04022024 | Aqueous | PFOS | 1633 | 1800 | HM-03 | ng/L | 88 |
| 012 | VRTB-S-R7_04022024 | Aqueous | 8:2FTS | 1633 | 59 | | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | 6:2FTS | 1633 | 140 | | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFBS | 1633 | 25 | | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFBA | 1633 | 54 | | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFDA | 1633 | 0.32 | JM-03 | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFHpS | 1633 | 270 | | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFHpA | 1633 | 150 | | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFHxA | 1633 | 230 | | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFNS | 1633 | 1.4 | M-03 | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFNA | 1633 | 96 | M-03 | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFOSA | 1633 | 4.7 | M-03 | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFOA | 1633 | 300 | | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFPeS | 1633 | 71 | | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFPeA | 1633 | 130 | | ng/L | 90 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFHxS | 1633 | 2100 | | ng/L | 92 |
| 012 | VRTB-S-R7_04022024 | Aqueous | PFOS | 1633 | 23000 | HM-03 | ng/L | 94 |
| 013 | VRTB-S-P8_04022024 | Aqueous | 8:2FTS | 1633 | 9.7 | | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | 6:2FTS | 1633 | 24 | | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFBS | 1633 | 47 | | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFBA | 1633 | 24 | M-03 | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFHpS | 1633 | 140 | | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFHpA | 1633 | 40 | | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFHxA | 1633 | 78 | | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFNA | 1633 | 36 | M-03 | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFOSA | 1633 | 1.6 | M-03 | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFOA | 1633 | 96 | | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFPeS | 1633 | 42 | M-03 | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFPeA | 1633 | 46 | M-03 | ng/L | 96 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFHxS | 1633 | 1300 | | ng/L | 98 |
| 013 | VRTB-S-P8_04022024 | Aqueous | PFOS | 1633 | 9600 | HM-03 | ng/L | 100 |
| 014 | VRTB-D-B1_04022024 | Aqueous | 8:2FTS | 1633 | 3.4 | JM-03 | ng/L | 102 |
| 014 | VRTB-D-B1_04022024 | Aqueous | 6:2FTS | 1633 | 24 | M-03 | ng/L | 102 |
| 014 | VRTB-D-B1_04022024 | Aqueous | PFBS | 1633 | 13 | | ng/L | 102 |
| 014 | VRTB-D-B1_04022024 | Aqueous | PFBA | 1633 | 20 | M-03 | ng/L | 102 |
| 014 | VRTB-D-B1_04022024 | Aqueous | PFHpS | 1633 | 41 | | ng/L | 102 |
| 014 | VRTB-D-B1_04022024 | Aqueous | PFHpA | 1633 | 56 | M-03 | ng/L | 102 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 014 | VRTB-D-B1_04022024 | Aqueous | PFHxA | 1633 | 49 | | ng/L | 102 |
| 014 | VRTB-D-B1_04022024 | Aqueous | PFNA | 1633 | 20 | M-03 | ng/L | 102 |
| 014 | VRTB-D-B1_04022024 | Aqueous | PFOA | 1633 | 110 | M-03 | ng/L | 102 |
| 014 | VRTB-D-B1_04022024 | Aqueous | PFPeS | 1633 | 29 | | ng/L | 102 |
| 014 | VRTB-D-B1_04022024 | Aqueous | PFPeA | 1633 | 39 | | ng/L | 102 |
| 014 | VRTB-D-B1_04022024 | Aqueous | PFHxS | 1633 | 830 | | ng/L | 104 |
| 014 | VRTB-D-B1_04022024 | Aqueous | PFOS | 1633 | 2300 | HM-03 | ng/L | 106 |
| 015 | VRTB-D-S2_04022024 | Aqueous | PFBS | 1633 | 18 | M-03 | ng/L | 108 |
| 015 | VRTB-D-S2_04022024 | Aqueous | PFBA | 1633 | 5.8 | M-03 | ng/L | 108 |
| 015 | VRTB-D-S2_04022024 | Aqueous | PFHpS | 1633 | 8.3 | M-03 | ng/L | 108 |
| 015 | VRTB-D-S2_04022024 | Aqueous | PFHpA | 1633 | 7.1 | M-03 | ng/L | 108 |
| 015 | VRTB-D-S2_04022024 | Aqueous | PFHxS | 1633 | 170 | | ng/L | 108 |
| 015 | VRTB-D-S2_04022024 | Aqueous | PFHxA | 1633 | 12 | M-03 | ng/L | 108 |
| 015 | VRTB-D-S2_04022024 | Aqueous | PFNA | 1633 | 0.73 | JM-03 | ng/L | 108 |
| 015 | VRTB-D-S2_04022024 | Aqueous | PFOA | 1633 | 16 | M-03 | ng/L | 108 |
| 015 | VRTB-D-S2_04022024 | Aqueous | PFPeS | 1633 | 37 | | ng/L | 108 |
| 015 | VRTB-D-S2_04022024 | Aqueous | PFPeA | 1633 | 9.0 | M-03 | ng/L | 108 |
| 015 | VRTB-D-S2_04022024 | Aqueous | PFOS | 1633 | 240 | HM-03 | ng/L | 110 |
| 016 | VRTB-D-Y3_04022024 | Aqueous | PFBS | 1633 | 2.8 | M-03 | ng/L | 112 |
| 016 | VRTB-D-Y3_04022024 | Aqueous | PFBA | 1633 | 4.7 | M-03 | ng/L | 112 |
| 016 | VRTB-D-Y3_04022024 | Aqueous | PFHpS | 1633 | 1.9 | M-03 | ng/L | 112 |
| 016 | VRTB-D-Y3_04022024 | Aqueous | PFHpA | 1633 | 3.0 | M-03 | ng/L | 112 |
| 016 | VRTB-D-Y3_04022024 | Aqueous | PFHxS | 1633 | 59 | | ng/L | 112 |
| 016 | VRTB-D-Y3_04022024 | Aqueous | PFHxA | 1633 | 5.0 | M-03 | ng/L | 112 |
| 016 | VRTB-D-Y3_04022024 | Aqueous | PFOA | 1633 | 5.2 | M-03 | ng/L | 112 |
| 016 | VRTB-D-Y3_04022024 | Aqueous | PFPeS | 1633 | 7.1 | | ng/L | 112 |
| 016 | VRTB-D-Y3_04022024 | Aqueous | PFPeA | 1633 | 3.9 | M-03 | ng/L | 112 |
| 016 | VRTB-D-Y3_04022024 | Aqueous | PFOS | 1633 | 90 | HM-03 | ng/L | 114 |
| 017 | VRTB-D-G4_04022024 | Aqueous | PFBS | 1633 | 1.1 | M-03 | ng/L | 116 |
| 017 | VRTB-D-G4_04022024 | Aqueous | PFBA | 1633 | 5.8 | M-03 | ng/L | 116 |
| 017 | VRTB-D-G4_04022024 | Aqueous | PFHpS | 1633 | 1.7 | M-03 | ng/L | 116 |
| 017 | VRTB-D-G4_04022024 | Aqueous | PFHpA | 1633 | 3.7 | M-03 | ng/L | 116 |
| 017 | VRTB-D-G4_04022024 | Aqueous | PFHxS | 1633 | 46 | M-03 | ng/L | 116 |
| 017 | VRTB-D-G4_04022024 | Aqueous | PFHxA | 1633 | 8.1 | | ng/L | 116 |
| 017 | VRTB-D-G4_04022024 | Aqueous | PFNA | 1633 | 0.61 | JM-03 | ng/L | 116 |
| 017 | VRTB-D-G4_04022024 | Aqueous | PFOA | 1633 | 3.9 | | ng/L | 116 |
| 017 | VRTB-D-G4_04022024 | Aqueous | PFPeS | 1633 | 1.4 | | ng/L | 116 |
| 017 | VRTB-D-G4_04022024 | Aqueous | PFPeA | 1633 | 8.6 | M-03 | ng/L | 116 |
| 017 | VRTB-D-G4_04022024 | Aqueous | PFOS | 1633 | 120 | HM-03 | ng/L | 118 |
| 018 | VRTB-D-M5_04032024 | Aqueous | PFBS | 1633 | 3.2 | M-03 | ng/L | 120 |
| 018 | VRTB-D-M5_04032024 | Aqueous | PFBA | 1633 | 7.7 | M-03 | ng/L | 120 |
| 018 | VRTB-D-M5_04032024 | Aqueous | PFHpS | 1633 | 4.6 | M-03 | ng/L | 120 |
| 018 | VRTB-D-M5_04032024 | Aqueous | PFHpA | 1633 | 7.2 | | ng/L | 120 |
| 018 | VRTB-D-M5_04032024 | Aqueous | PFHxS | 1633 | 82 | M-03 | ng/L | 120 |
| 018 | VRTB-D-M5_04032024 | Aqueous | PFHxA | 1633 | 13 | M-03 | ng/L | 120 |
| 018 | VRTB-D-M5_04032024 | Aqueous | PFNA | 1633 | 1.3 | M-03 | ng/L | 120 |
| 018 | VRTB-D-M5_04032024 | Aqueous | PFOS | 1633 | 280 | M-03 | ng/L | 120 |
| 018 | VRTB-D-M5_04032024 | Aqueous | PFOA | 1633 | 9.2 | M-03 | ng/L | 120 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 018 | VRTB-D-M5_04032024 | Aqueous | PFPeS | 1633 | 3.8 | M-03 | ng/L | 120 |
| 018 | VRTB-D-M5_04032024 | Aqueous | PFPeA | 1633 | 11 | | ng/L | 120 |
| 019 | VRTB-D-06_04032024 | Aqueous | PFBS | 1633 | 2.4 | M-03 | ng/L | 122 |
| 019 | VRTB-D-06_04032024 | Aqueous | PFBA | 1633 | 8.1 | M-03 | ng/L | 122 |
| 019 | VRTB-D-06_04032024 | Aqueous | PFHpS | 1633 | 7.0 | M-03 | ng/L | 122 |
| 019 | VRTB-D-06_04032024 | Aqueous | PFHpA | 1633 | 7.9 | | ng/L | 122 |
| 019 | VRTB-D-06_04032024 | Aqueous | PFHxS | 1633 | 110 | M-03 | ng/L | 122 |
| 019 | VRTB-D-06_04032024 | Aqueous | PFHxA | 1633 | 14 | M-03 | ng/L | 122 |
| 019 | VRTB-D-06_04032024 | Aqueous | PFNA | 1633 | 1.5 | M-03 | ng/L | 122 |
| 019 | VRTB-D-06_04032024 | Aqueous | PFOS | 1633 | 300 | M-03 | ng/L | 122 |
| 019 | VRTB-D-06_04032024 | Aqueous | PFOA | 1633 | 9.6 | M-03 | ng/L | 122 |
| 019 | VRTB-D-06_04032024 | Aqueous | PFPeS | 1633 | 4.7 | | ng/L | 122 |
| 019 | VRTB-D-06_04032024 | Aqueous | PFPeA | 1633 | 9.6 | | ng/L | 122 |
| 020 | VRTB-D-R7_04032024 | Aqueous | PFBS | 1633 | 8.5 | | ng/L | 124 |
| 020 | VRTB-D-R7_04032024 | Aqueous | PFBA | 1633 | 11 | | ng/L | 124 |
| 020 | VRTB-D-R7_04032024 | Aqueous | PFHpS | 1633 | 2.3 | M-03 | ng/L | 124 |
| 020 | VRTB-D-R7_04032024 | Aqueous | PFHpA | 1633 | 23 | | ng/L | 124 |
| 020 | VRTB-D-R7_04032024 | Aqueous | PFHxS | 1633 | 85 | M-03 | ng/L | 124 |
| 020 | VRTB-D-R7_04032024 | Aqueous | PFHxA | 1633 | 20 | M-03 | ng/L | 124 |
| 020 | VRTB-D-R7_04032024 | Aqueous | PFNA | 1633 | 1.7 | M-03 | ng/L | 124 |
| 020 | VRTB-D-R7_04032024 | Aqueous | PFOS | 1633 | 97 | M-03 | ng/L | 124 |
| 020 | VRTB-D-R7_04032024 | Aqueous | PFOA | 1633 | 16 | M-03 | ng/L | 124 |
| 020 | VRTB-D-R7_04032024 | Aqueous | PFPeS | 1633 | 2.2 | | ng/L | 124 |
| 020 | VRTB-D-R7_04032024 | Aqueous | PFPeA | 1633 | 21 | M-03 | ng/L | 124 |
| 021 | VRTB-D-P8_04032024 | Aqueous | PFBS | 1633 | 9.5 | | ng/L | 126 |
| 021 | VRTB-D-P8_04032024 | Aqueous | PFBA | 1633 | 14 | M-03 | ng/L | 126 |
| 021 | VRTB-D-P8_04032024 | Aqueous | PFHpS | 1633 | 3.3 | M-03 | ng/L | 126 |
| 021 | VRTB-D-P8_04032024 | Aqueous | PFHpA | 1633 | 30 | | ng/L | 126 |
| 021 | VRTB-D-P8_04032024 | Aqueous | PFHxS | 1633 | 160 | | ng/L | 126 |
| 021 | VRTB-D-P8_04032024 | Aqueous | PFHxA | 1633 | 29 | | ng/L | 126 |
| 021 | VRTB-D-P8_04032024 | Aqueous | PFNA | 1633 | 7.5 | M-03 | ng/L | 126 |
| 021 | VRTB-D-P8_04032024 | Aqueous | PFOS | 1633 | 270 | M-03 | ng/L | 126 |
| 021 | VRTB-D-P8_04032024 | Aqueous | PFOA | 1633 | 25 | M-03 | ng/L | 126 |
| 021 | VRTB-D-P8_04032024 | Aqueous | PFPeS | 1633 | 6.6 | | ng/L | 126 |
| 021 | VRTB-D-P8_04032024 | Aqueous | PFPeA | 1633 | 28 | | ng/L | 126 |
| 022 | VRTB-S-B1_04032024 | Aqueous | PFBS | 1633 | 3.8 | | ng/L | 128 |
| 022 | VRTB-S-B1_04032024 | Aqueous | PFBA | 1633 | 5.2 | | ng/L | 128 |
| 022 | VRTB-S-B1_04032024 | Aqueous | PFHpS | 1633 | 1.0 | M-03 | ng/L | 128 |
| 022 | VRTB-S-B1_04032024 | Aqueous | PFHpA | 1633 | 3.0 | M-03 | ng/L | 128 |
| 022 | VRTB-S-B1_04032024 | Aqueous | PFHxS | 1633 | 33 | | ng/L | 128 |
| 022 | VRTB-S-B1_04032024 | Aqueous | PFHxA | 1633 | 5.8 | M-03 | ng/L | 128 |
| 022 | VRTB-S-B1_04032024 | Aqueous | PFNA | 1633 | 0.34 | JM-03 | ng/L | 128 |
| 022 | VRTB-S-B1_04032024 | Aqueous | PFOS | 1633 | 130 | M-03 | ng/L | 128 |
| 022 | VRTB-S-B1_04032024 | Aqueous | PFOA | 1633 | 2.6 | | ng/L | 128 |
| 022 | VRTB-S-B1_04032024 | Aqueous | PFPeS | 1633 | 2.2 | M-03 | ng/L | 128 |
| 022 | VRTB-S-B1_04032024 | Aqueous | PFPeA | 1633 | 4.8 | M-03 | ng/L | 128 |
| 023 | VRTB-S-S2_04032024 | Aqueous | 8:2FTS | 1633 | 0.61 | JM-03 | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFBS | 1633 | 6.6 | | ng/L | 130 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 023 | VRTB-S-S2_04032024 | Aqueous | PFBA | 1633 | 16 | | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFHpS | 1633 | 10 | | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFHpA | 1633 | 23 | | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFHxS | 1633 | 160 | M-03 | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFHxA | 1633 | 24 | | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFNS | 1633 | 0.31 | JM-03 | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFNA | 1633 | 20 | | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFOSA | 1633 | 0.86 | JM-03 | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFOS | 1633 | 650 | M-03 | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFOA | 1633 | 39 | M-03 | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFPeS | 1633 | 7.7 | | ng/L | 130 |
| 023 | VRTB-S-S2_04032024 | Aqueous | PFPeA | 1633 | 25 | M-03 | ng/L | 130 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | 8:2FTS | 1633 | 3.8 | M-03 | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFBS | 1633 | 7.6 | M-03 | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFBA | 1633 | 14 | M-03 | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFHpS | 1633 | 32 | | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFHpA | 1633 | 12 | | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFHxS | 1633 | 450 | M-03 | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFHxA | 1633 | 30 | | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFNA | 1633 | 5.5 | M-03 | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFOSA | 1633 | 1.5 | M-03 | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFOS | 1633 | 1100 | M-03 | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFOA | 1633 | 23 | M-03 | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFPeS | 1633 | 12 | M-03 | ng/L | 132 |
| 024 | VRTB-S-Y3_04032024 | Aqueous | PFPeA | 1633 | 21 | | ng/L | 132 |
| 025 | VRTB-S-G4_04032024 | Aqueous | PFBS | 1633 | 9.1 | M-03 | ng/L | 134 |
| 025 | VRTB-S-G4_04032024 | Aqueous | PFBA | 1633 | 7.2 | | ng/L | 134 |
| 025 | VRTB-S-G4_04032024 | Aqueous | PFHpS | 1633 | 24 | | ng/L | 134 |
| 025 | VRTB-S-G4_04032024 | Aqueous | PFHpA | 1633 | 9.0 | | ng/L | 134 |
| 025 | VRTB-S-G4_04032024 | Aqueous | PFHxS | 1633 | 550 | M-03 | ng/L | 134 |
| 025 | VRTB-S-G4_04032024 | Aqueous | PFHxA | 1633 | 21 | | ng/L | 134 |
| 025 | VRTB-S-G4_04032024 | Aqueous | PFNA | 1633 | 2.6 | M-03 | ng/L | 134 |
| 025 | VRTB-S-G4_04032024 | Aqueous | PFOS | 1633 | 850 | | ng/L | 134 |
| 025 | VRTB-S-G4_04032024 | Aqueous | PFOA | 1633 | 18 | M-03 | ng/L | 134 |
| 025 | VRTB-S-G4_04032024 | Aqueous | PFPeS | 1633 | 19 | | ng/L | 134 |
| 025 | VRTB-S-G4_04032024 | Aqueous | PFPeA | 1633 | 9.5 | | ng/L | 134 |
| 026 | VRTB-L-B1_04042024 | Aqueous | 8:2FTS | 1633 | 0.94 | JM-03 | ng/L | 136 |
| 026 | VRTB-L-B1_04042024 | Aqueous | PFBS | 1633 | 6.0 | | ng/L | 136 |
| 026 | VRTB-L-B1_04042024 | Aqueous | PFBA | 1633 | 7.4 | M-03 | ng/L | 136 |
| 026 | VRTB-L-B1_04042024 | Aqueous | PFHpS | 1633 | 10 | M-03 | ng/L | 136 |
| 026 | VRTB-L-B1_04042024 | Aqueous | PFHpA | 1633 | 7.8 | | ng/L | 136 |
| 026 | VRTB-L-B1_04042024 | Aqueous | PFHxS | 1633 | 130 | | ng/L | 136 |
| 026 | VRTB-L-B1_04042024 | Aqueous | PFHxA | 1633 | 13 | | ng/L | 136 |
| 026 | VRTB-L-B1_04042024 | Aqueous | PFNA | 1633 | 2.8 | M-03 | ng/L | 136 |
| 026 | VRTB-L-B1_04042024 | Aqueous | PFOS | 1633 | 530 | BM-03 | ng/L | 136 |
| 026 | VRTB-L-B1_04042024 | Aqueous | PFOA | 1633 | 21 | M-03 | ng/L | 136 |
| 026 | VRTB-L-B1_04042024 | Aqueous | PFPeS | 1633 | 9.3 | M-03 | ng/L | 136 |
| 026 | VRTB-L-B1_04042024 | Aqueous | PFPeA | 1633 | 9.2 | | ng/L | 136 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 027 | VRTB-L-S2_04042024 | Aqueous | 8:2FTS | 1633 | 6.4 | | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | 6:2FTS | 1633 | 2.8 | J | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFBS | 1633 | 5.8 | M-03 | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFBA | 1633 | 8.3 | M-03 | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFHpS | 1633 | 13 | | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFHpA | 1633 | 9.2 | | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFHxS | 1633 | 150 | | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFHxA | 1633 | 14 | M-03 | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFNA | 1633 | 4.7 | M-03 | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFOSA | 1633 | 1.2 | M-03 | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFOA | 1633 | 27 | M-03 | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFPeS | 1633 | 9.5 | | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFPeA | 1633 | 10 | M-03 | ng/L | 138 |
| 027 | VRTB-L-S2_04042024 | Aqueous | PFOS | 1633 | 620 | BHM-03 | ng/L | 140 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | 8:2FTS | 1633 | 46 | | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | 6:2FTS | 1633 | 4.5 | J | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFBS | 1633 | 4.2 | M-03 | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFBA | 1633 | 8.9 | | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFHpS | 1633 | 15 | M-03 | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFHpA | 1633 | 12 | | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFHxS | 1633 | 140 | M-03 | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFHxA | 1633 | 13 | | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFNS | 1633 | 0.26 | JM-03 | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFNA | 1633 | 6.4 | M-03 | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFOSA | 1633 | 3.1 | M-03 | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFOS | 1633 | 1200 | BM-03 | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFOA | 1633 | 24 | M-03 | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFPeS | 1633 | 6.0 | M-03 | ng/L | 142 |
| 028 | VRTB-L-Y3_04042024 | Aqueous | PFPeA | 1633 | 12 | M-03 | ng/L | 142 |
| 029 | VRTB-L-G4_04042024 | Aqueous | 8:2FTS | 1633 | 52 | M-03 | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | 6:2FTS | 1633 | 20 | | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFBS | 1633 | 5.5 | M-03 | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFBA | 1633 | 17 | | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFHpS | 1633 | 30 | | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFHpA | 1633 | 32 | | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFHxS | 1633 | 310 | | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFHxA | 1633 | 34 | | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFNA | 1633 | 20 | M-03 | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFOSA | 1633 | 1.9 | | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFOS | 1633 | 3200 | BM-03 | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFOA | 1633 | 55 | | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFPeS | 1633 | 9.8 | M-03 | ng/L | 144 |
| 029 | VRTB-L-G4_04042024 | Aqueous | PFPeA | 1633 | 29 | | ng/L | 144 |
| 030 | DUP-01_04022024 | Aqueous | 8:2FTS | 1633 | 56 | | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | 6:2FTS | 1633 | 130 | | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | PFBS | 1633 | 23 | | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | PFBA | 1633 | 45 | M-03 | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | PFHpS | 1633 | 180 | | ng/L | 146 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 030 | DUP-01_04022024 | Aqueous | PFHpA | 1633 | 140 | | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | PFHxS | 1633 | 2200 | M-03 | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | PFHxA | 1633 | 220 | M-03 | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | PFNA | 1633 | 88 | M-03 | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | PFOSA | 1633 | 4.1 | JM-03 | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | PFOA | 1633 | 270 | M-03 | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | PFPeS | 1633 | 53 | | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | PFPeA | 1633 | 120 | M-03 | ng/L | 146 |
| 030 | DUP-01_04022024 | Aqueous | PFOS | 1633 | 22000 | BHSM-03 | ng/L | 148 |
| 031 | DUP-02_04042024 | Aqueous | 8:2FTS | 1633 | 64 | M-03 | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | 6:2FTS | 1633 | 24 | JM-03 | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | PFBS | 1633 | 5.3 | J | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | PFBA | 1633 | 17 | JM-03 | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | PFHpS | 1633 | 24 | M-03 | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | PFHpA | 1633 | 34 | | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | PFHxS | 1633 | 320 | | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | PFHxA | 1633 | 32 | M-03 | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | PFNA | 1633 | 20 | M-03 | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | PFOS | 1633 | 3100 | BM-03 | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | PFOA | 1633 | 62 | M-03 | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | PFPeS | 1633 | 11 | | ng/L | 150 |
| 031 | DUP-02_04042024 | Aqueous | PFPeA | 1633 | 29 | M-03 | ng/L | 150 |

(401 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-001
Description: CMT-VRTB-01_1_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1305 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 5 | 05/02/2024 2303 | BWS | 04/24/2024 1716 | 10620 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 10 | U | 18 | 10 | 3.9 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 9.9 | U | 18 | 9.9 | 3.0 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 10 | U | 18 | 10 | 3.0 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 6.8 | U | 18 | 6.8 | 2.7 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 6.8 | U | 18 | 6.8 | 1.8 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 20 | U | 22 | 20 | 9.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 44 | U | 110 | 44 | 19 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 18 | 11 | 4.4 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.57 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.6 | U | 4.5 | 3.6 | 1.3 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.0 | U | 45 | 9.0 | 2.7 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.6 | U | 4.5 | 3.6 | 0.96 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.6 | U | 4.5 | 3.6 | 1.3 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.0 | U | 45 | 9.0 | 2.8 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 5.8 | U | 8.9 | 5.8 | 2.6 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 4.9 | U | 8.9 | 4.9 | 1.6 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 2.8 | U | 8.9 | 2.8 | 0.82 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 5.8 | U | 8.9 | 5.8 | 1.7 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 55 | | 4.5 | 1.6 | 0.42 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 16 | J | 18 | 7.2 | 2.3 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.73 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.60 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.69 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.48 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 8.0 | | 4.5 | 1.7 | 0.85 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 73 | | 4.5 | 3.6 | 0.95 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 44 | U | 110 | 44 | 19 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 50 | M-03 | 4.5 | 3.3 | 0.82 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 39 | | 4.5 | 1.8 | 0.63 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.7 | U | 4.5 | 1.7 | 0.65 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 11 | M-03 | 4.5 | 1.8 | 0.46 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.88 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1300 | M-03 | 4.5 | 3.3 | 1.1 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 140 | | 4.5 | 3.6 | 0.93 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 1.9 | JM-03 | 4.5 | 3.4 | 1.1 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 40 | | 8.9 | 1.8 | 0.82 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 8.8 | U | 22 | 8.8 | 2.7 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.6 | U | 4.5 | 3.6 | 1.2 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.87 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.6 | U | 4.5 | 3.6 | 1.1 | ng/L | 1 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-001
Description: CMT-VRTB-01_1_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1305
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 112 | 20-150 |
| 13C2-6:2FTS | | 102 | 20-150 |
| 13C2-8:2FTS | | 104 | 20-150 |
| 13C2-PFDoA | | 85 | 20-150 |
| 13C2-PFTeDA | | 79 | 20-150 |
| 13C3-HFPO-DA | | 116 | 20-150 |
| 13C3-PFBS | | 113 | 20-150 |
| 13C3-PFHxS | | 100 | 20-150 |
| 13C4-PFBA | | 107 | 20-150 |
| 13C4-PFHpA | | 104 | 20-150 |
| 13C5-PFHxA | | 113 | 20-150 |
| 13C5-PFPeA | | 104 | 20-150 |
| 13C6-PFDA | | 85 | 20-150 |
| 13C7-PFUnA | | 91 | 20-150 |
| 13C8-PFOA | | 92 | 20-150 |
| 13C8-PFOS | | 110 | 20-150 |
| 13C8-PFOSA | | 92 | 20-150 |
| 13C9-PFNA | | 104 | 20-150 |
| D3-NMeFOSA | | 94 | 20-150 |
| D3-NMeFOSAA | | 92 | 20-150 |
| D5-NEtFOSA | M-03 | 91 | 20-150 |
| D5-NEtFOSAA | | 94 | 20-150 |
| D7-NMeFOSE | | 81 | 20-150 |
| D9-NEtFOSE | | 69 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-002
Description: CMT-VRTB-01_2_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1415 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 10 | 05/02/2024 2312 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 1 | 05/07/2024 0430 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 21 | U | 36 | 21 | 7.9 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 20 | U | 36 | 20 | 6.0 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 21 | U | 36 | 21 | 6.0 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 28 | JM-03 | 36 | 14 | 5.5 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 14 | U | 36 | 14 | 3.6 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 120 | M-03 | 45 | 41 | 18 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 92 | U | 230 | 92 | 39 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 22 | U | 36 | 22 | 9.0 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.6 | U | 9.0 | 3.6 | 1.2 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.2 | U | 9.0 | 7.2 | 2.6 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 18 | U | 90 | 18 | 5.5 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.2 | U | 9.0 | 7.2 | 1.9 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.2 | U | 9.0 | 7.2 | 2.7 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 18 | U | 90 | 18 | 5.7 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 12 | U | 18 | 12 | 5.2 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 9.9 | U | 18 | 9.9 | 3.3 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 5.8 | U | 18 | 5.8 | 1.7 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 12 | U | 18 | 12 | 3.5 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 20 | M-03 | 9.0 | 3.2 | 0.85 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 41 | | 36 | 14 | 4.6 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.5 | U | 9.0 | 3.5 | 1.5 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.6 | U | 9.0 | 3.6 | 1.2 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.5 | U | 9.0 | 3.5 | 1.4 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.6 | U | 9.0 | 3.6 | 0.96 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 180 | | 9.0 | 3.4 | 1.7 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 100 | M-03 | 9.0 | 7.2 | 1.9 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 92 | U | 230 | 92 | 38 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2100 | M-03 | 9.0 | 6.6 | 1.7 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 190 | | 9.0 | 3.6 | 1.3 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.4 | U | 9.0 | 3.4 | 1.3 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 73 | M-03 | 9.0 | 3.6 | 0.93 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.9 | JM-03 | 9.0 | 3.6 | 1.8 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 23000 | EM-03 | 9.0 | 6.7 | 2.2 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 330 | M-03 | 9.0 | 7.2 | 1.9 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 46 | M-03 | 9.0 | 6.8 | 2.3 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 100 | M-03 | 18 | 3.6 | 1.7 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 18 | U | 45 | 18 | 5.4 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.2 | U | 9.0 | 7.2 | 2.4 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.6 | U | 9.0 | 3.6 | 1.8 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.2 | U | 9.0 | 7.2 | 2.2 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-002
Description: CMT-VRTB-01_2_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1415
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 | H | 68 | 20-150 |
| 13C2-6:2FTS | | 111 | 20-150 | HM-03 | 67 | 20-150 |
| 13C2-8:2FTS | M-03 | 91 | 20-150 | H | 68 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 | H | 69 | 20-150 |
| 13C2-PFTeDA | M-03 | 77 | 20-150 | H | 64 | 20-150 |
| 13C3-HFPO-DA | | 97 | 20-150 | H | 70 | 20-150 |
| 13C3-PFBS | | 107 | 20-150 | H | 66 | 20-150 |
| 13C3-PFHxS | | 100 | 20-150 | H | 65 | 20-150 |
| 13C4-PFBA | | 99 | 20-150 | H | 69 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | H | 72 | 20-150 |
| 13C5-PFHxA | | 97 | 20-150 | H | 68 | 20-150 |
| 13C5-PFPeA | | 93 | 20-150 | H | 70 | 20-150 |
| 13C6-PFDA | M-03 | 84 | 20-150 | H | 61 | 20-150 |
| 13C7-PFUnA | | 76 | 20-150 | H | 66 | 20-150 |
| 13C8-PFOA | | 95 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOS | | 115 | 20-150 | H | 62 | 20-150 |
| 13C8-PFOSA | M-03 | 117 | 20-150 | H | 64 | 20-150 |
| 13C9-PFNA | | 113 | 20-150 | H | 69 | 20-150 |
| D3-NMeFOSA | | 101 | 20-150 | H | 41 | 20-150 |
| D3-NMeFOSAA | M-03 | 112 | 20-150 | H | 64 | 20-150 |
| D5-NEtFOSA | M-03 | 109 | 20-150 | H | 44 | 20-150 |
| D5-NEtFOSAA | | 101 | 20-150 | H | 66 | 20-150 |
| D7-NMeFOSE | M-03 | 109 | 20-150 | H | 58 | 20-150 |
| D9-NEtFOSE | | 97 | 20-150 | H | 56 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-002

Description: CMT-VRTB-01_2_04012024 | Matrix: Aqueous

Date Sampled: 04/01/2024 1415 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 10 | 05/02/2024 2312 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 1 | 05/07/2024 0430 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | UH | 400 | 230 | 87 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | UH | 400 | 220 | 67 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | UH | 400 | 230 | 66 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 150 | UH | 400 | 150 | 61 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | UH | 400 | 150 | 40 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 460 | UHM-03 | 500 | 460 | 200 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | UH | 2500 | 1000 | 430 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | UH | 400 | 240 | 99 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | UH | 100 | 40 | 13 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | UH | 1000 | 200 | 61 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | UH | 100 | 80 | 22 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | UH | 1000 | 200 | 63 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | UH | 200 | 130 | 58 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | UH | 200 | 110 | 36 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | UH | 200 | 64 | 18 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | UH | 200 | 130 | 39 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 34 | HJM-03 | 100 | 35 | 9.4 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 65 | HJM-03 | 400 | 160 | 51 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | UH | 100 | 39 | 16 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | UH | 100 | 40 | 14 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | UH | 100 | 39 | 15 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | UH | 100 | 40 | 11 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 190 | HM-03 | 100 | 38 | 19 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 120 | HM-03 | 100 | 80 | 21 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | UH | 2500 | 1000 | 420 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2800 | BHM-03 | 100 | 73 | 18 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 270 | HM-03 | 100 | 40 | 14 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | UH | 100 | 38 | 15 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 130 | HM-03 | 100 | 40 | 10 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | HJM-03 | 100 | 40 | 20 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 30000 | BHM-03 | 100 | 74 | 25 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 390 | HM-03 | 100 | 80 | 21 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 66 | HJM-03 | 100 | 75 | 26 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 40 | UH | 200 | 40 | 18 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | UH | 500 | 200 | 60 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | UH | 100 | 80 | 27 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | UH | 100 | 40 | 19 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | UH | 100 | 80 | 25 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-002
Description: CMT-VRTB-01_2_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1415
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 | H | 68 | 20-150 |
| 13C2-6:2FTS | | 111 | 20-150 | HM-03 | 67 | 20-150 |
| 13C2-8:2FTS | M-03 | 91 | 20-150 | H | 68 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 | H | 69 | 20-150 |
| 13C2-PFTeDA | M-03 | 77 | 20-150 | H | 64 | 20-150 |
| 13C3-HFPO-DA | | 97 | 20-150 | H | 70 | 20-150 |
| 13C3-PFBS | | 107 | 20-150 | H | 66 | 20-150 |
| 13C3-PFHxS | | 100 | 20-150 | H | 65 | 20-150 |
| 13C4-PFBA | | 99 | 20-150 | H | 69 | 20-150 |
| 13C4-PFHpA | | 92 | 20-150 | H | 72 | 20-150 |
| 13C5-PFHxA | | 97 | 20-150 | H | 68 | 20-150 |
| 13C5-PFPeA | | 93 | 20-150 | H | 70 | 20-150 |
| 13C6-PFDA | M-03 | 84 | 20-150 | H | 61 | 20-150 |
| 13C7-PFUnA | | 76 | 20-150 | H | 66 | 20-150 |
| 13C8-PFOA | | 95 | 20-150 | H | 75 | 20-150 |
| 13C8-PFOS | | 115 | 20-150 | H | 62 | 20-150 |
| 13C8-PFOSA | M-03 | 117 | 20-150 | H | 64 | 20-150 |
| 13C9-PFNA | | 113 | 20-150 | H | 69 | 20-150 |
| D3-NMeFOSA | | 101 | 20-150 | H | 41 | 20-150 |
| D3-NMeFOSAA | M-03 | 112 | 20-150 | H | 64 | 20-150 |
| D5-NEtFOSA | M-03 | 109 | 20-150 | H | 44 | 20-150 |
| D5-NEtFOSAA | | 101 | 20-150 | H | 66 | 20-150 |
| D7-NMeFOSE | M-03 | 109 | 20-150 | H | 58 | 20-150 |
| D9-NEtFOSE | | 97 | 20-150 | H | 56 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-003
Description: CMT-VRTB-01_3_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1515 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0316 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 1 | 05/07/2024 0440 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.82 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.63 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 16 | M-03 | 3.8 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 21 | | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.93 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.4 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.4 | 1.9 | 0.59 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.4 | M-03 | 0.94 | 0.33 | 0.088 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 15 | | 3.8 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 48 | | 0.94 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 26 | | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 400 | | 0.94 | 0.69 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 27 | | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.94 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 28 | M-03 | 0.94 | 0.38 | 0.097 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.61 | JM-03 | 0.94 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 5800 | ESM-03 | 0.94 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 63 | M-03 | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 8.6 | M-03 | 0.94 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 26 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.56 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-003
Description: CMT-VRTB-01_3_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1515
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 112 | 20-150 | H | 83 | 20-150 |
| 13C2-6:2FTS | | 106 | 20-150 | H | 81 | 20-150 |
| 13C2-8:2FTS | | 104 | 20-150 | H | 78 | 20-150 |
| 13C2-PFDoA | | 82 | 20-150 | H | 84 | 20-150 |
| 13C2-PFTeDA | | 73 | 20-150 | H | 78 | 20-150 |
| 13C3-HFPO-DA | | 100 | 20-150 | H | 83 | 20-150 |
| 13C3-PFBS | | 111 | 20-150 | H | 81 | 20-150 |
| 13C3-PFHxS | | 107 | 20-150 | H | 83 | 20-150 |
| 13C4-PFBA | | 105 | 20-150 | H | 82 | 20-150 |
| 13C4-PFHpA | | 101 | 20-150 | H | 86 | 20-150 |
| 13C5-PFHxA | | 103 | 20-150 | H | 83 | 20-150 |
| 13C5-PFPeA | | 103 | 20-150 | H | 82 | 20-150 |
| 13C6-PFDA | | 99 | 20-150 | H | 81 | 20-150 |
| 13C7-PFUnA | | 81 | 20-150 | H | 81 | 20-150 |
| 13C8-PFOA | | 96 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOS | | 92 | 20-150 | H | 85 | 20-150 |
| 13C8-PFOSA | | 133 | 20-150 | H | 88 | 20-150 |
| 13C9-PFNA | | 114 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 120 | 20-150 | H | 69 | 20-150 |
| D3-NMeFOSAA | | 122 | 20-150 | H | 84 | 20-150 |
| D5-NEtFOSA | | 119 | 20-150 | H | 68 | 20-150 |
| D5-NEtFOSAA | | 104 | 20-150 | H | 89 | 20-150 |
| D7-NMeFOSE | | 122 | 20-150 | H | 86 | 20-150 |
| D9-NEtFOSE | | 115 | 20-150 | H | 85 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-003
Description: CMT-VRTB-01_3_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1515 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0316 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 1 | 05/07/2024 0440 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 46 | UH | 80 | 46 | 17 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 44 | UH | 80 | 44 | 13 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 46 | UH | 80 | 46 | 13 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 21 | HJM-03 | 80 | 30 | 12 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 30 | UH | 80 | 30 | 8.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 92 | UHM-03 | 100 | 92 | 40 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 200 | UH | 500 | 200 | 86 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 48 | UH | 80 | 48 | 20 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.6 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 16 | UH | 20 | 16 | 5.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 40 | UH | 200 | 40 | 12 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 16 | UH | 20 | 16 | 4.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 16 | UH | 20 | 16 | 5.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 40 | UH | 200 | 40 | 13 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 26 | UH | 40 | 26 | 12 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 22 | UH | 40 | 22 | 7.2 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 13 | UH | 40 | 13 | 3.7 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 26 | UH | 40 | 26 | 7.8 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 10 | HJM-03 | 20 | 7.0 | 1.9 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 21 | HJM-03 | 80 | 32 | 10 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 7.8 | UH | 20 | 7.8 | 3.3 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.7 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 7.8 | UH | 20 | 7.8 | 3.1 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 8.0 | UH | 20 | 8.0 | 2.1 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 38 | HM-03 | 20 | 7.6 | 3.8 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 32 | HM-03 | 20 | 16 | 4.3 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 200 | UH | 500 | 200 | 84 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 470 | BH | 20 | 15 | 3.7 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 37 | HM-03 | 20 | 8.0 | 2.8 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 7.6 | UH | 20 | 7.6 | 2.9 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 39 | HM-03 | 20 | 8.0 | 2.1 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 8.0 | UH | 20 | 8.0 | 4.0 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 5600 | BHM-03 | 20 | 15 | 4.9 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 69 | HM-03 | 20 | 16 | 4.2 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.3 | HJM-03 | 20 | 15 | 5.1 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 34 | HJM-03 | 40 | 8.0 | 3.7 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 40 | UH | 100 | 40 | 12 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 16 | UH | 20 | 16 | 5.4 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 8.0 | UH | 20 | 8.0 | 3.9 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 16 | UH | 20 | 16 | 5.0 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-003
Description: CMT-VRTB-01_3_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1515
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 112 | 20-150 | H | 83 | 20-150 |
| 13C2-6:2FTS | | 106 | 20-150 | H | 81 | 20-150 |
| 13C2-8:2FTS | | 104 | 20-150 | H | 78 | 20-150 |
| 13C2-PFDoA | | 82 | 20-150 | H | 84 | 20-150 |
| 13C2-PFTeDA | | 73 | 20-150 | H | 78 | 20-150 |
| 13C3-HFPO-DA | | 100 | 20-150 | H | 83 | 20-150 |
| 13C3-PFBS | | 111 | 20-150 | H | 81 | 20-150 |
| 13C3-PFHxS | | 107 | 20-150 | H | 83 | 20-150 |
| 13C4-PFBA | | 105 | 20-150 | H | 82 | 20-150 |
| 13C4-PFHpA | | 101 | 20-150 | H | 86 | 20-150 |
| 13C5-PFHxA | | 103 | 20-150 | H | 83 | 20-150 |
| 13C5-PFPeA | | 103 | 20-150 | H | 82 | 20-150 |
| 13C6-PFDA | | 99 | 20-150 | H | 81 | 20-150 |
| 13C7-PFUnA | | 81 | 20-150 | H | 81 | 20-150 |
| 13C8-PFOA | | 96 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOS | | 92 | 20-150 | H | 85 | 20-150 |
| 13C8-PFOSA | | 133 | 20-150 | H | 88 | 20-150 |
| 13C9-PFNA | | 114 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 120 | 20-150 | H | 69 | 20-150 |
| D3-NMeFOSAA | | 122 | 20-150 | H | 84 | 20-150 |
| D5-NEtFOSA | | 119 | 20-150 | H | 68 | 20-150 |
| D5-NEtFOSAA | | 104 | 20-150 | H | 89 | 20-150 |
| D7-NMeFOSE | | 122 | 20-150 | H | 86 | 20-150 |
| D9-NEtFOSE | | 115 | 20-150 | H | 85 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-004
Description: CMT-VRTB-01_4_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1600 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0335 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 5 | 05/02/2024 2321 | BWS | 04/24/2024 1716 | 10620 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 27 | | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 7.1 | M-03 | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 13 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 24 | M-03 | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 21 | M-03 | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 440 | M-03 | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 24 | | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 13 | M-03 | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.38 | UM-03 | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1300 | M-03 | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 67 | M-03 | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 10 | M-03 | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 18 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-004
Description: CMT-VRTB-01_4_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1600
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 105 | 20-150 | M-03 | 97 | 20-150 |
| 13C2-6:2FTS | | 103 | 20-150 | | 106 | 20-150 |
| 13C2-8:2FTS | | 102 | 20-150 | | 95 | 20-150 |
| 13C2-PFDoA | | 95 | 20-150 | | 80 | 20-150 |
| 13C2-PFTeDA | | 91 | 20-150 | | 80 | 20-150 |
| 13C3-HFPO-DA | | 96 | 20-150 | | 106 | 20-150 |
| 13C3-PFBS | | 108 | 20-150 | | 99 | 20-150 |
| 13C3-PFHxS | | 101 | 20-150 | | 111 | 20-150 |
| 13C4-PFBA | | 103 | 20-150 | | 102 | 20-150 |
| 13C4-PFHpA | | 102 | 20-150 | | 108 | 20-150 |
| 13C5-PFHxA | | 104 | 20-150 | | 110 | 20-150 |
| 13C5-PFPeA | | 109 | 20-150 | | 108 | 20-150 |
| 13C6-PFDA | | 103 | 20-150 | | 84 | 20-150 |
| 13C7-PFUnA | | 102 | 20-150 | | 87 | 20-150 |
| 13C8-PFOA | | 100 | 20-150 | | 99 | 20-150 |
| 13C8-PFOS | | 102 | 20-150 | | 109 | 20-150 |
| 13C8-PFOSA | | 112 | 20-150 | | 99 | 20-150 |
| 13C9-PFNA | | 102 | 20-150 | | 96 | 20-150 |
| D3-NMeFOSA | | 104 | 20-150 | | 96 | 20-150 |
| D3-NMeFOSAA | | 98 | 20-150 | | 95 | 20-150 |
| D5-NEtFOSA | | 108 | 20-150 | | 95 | 20-150 |
| D5-NEtFOSAA | | 108 | 20-150 | | 91 | 20-150 |
| D7-NMeFOSE | | 110 | 20-150 | | 88 | 20-150 |
| D9-NEtFOSE | | 106 | 20-150 | | 87 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-005
Description: CMT-VRTB-01_5_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1640 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0344 | BWS | 04/24/2024 1716 | 10620 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.83 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.4 | U | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.5 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.5 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 7.4 | | 0.95 | 0.33 | 0.089 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 9.6 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 7.5 | M-03 | 0.95 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 9.5 | M-03 | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 190 | M-03 | 0.95 | 0.69 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 14 | M-03 | 0.95 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.95 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.8 | M-03 | 0.95 | 0.38 | 0.098 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 270 | M-03 | 0.95 | 0.70 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 20 | M-03 | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.2 | | 0.95 | 0.71 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 10 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-005
Description: CMT-VRTB-01_5_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1640
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 101 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 |
| 13C2-8:2FTS | M-03 | 95 | 20-150 |
| 13C2-PFDoA | | 93 | 20-150 |
| 13C2-PFTeDA | | 84 | 20-150 |
| 13C3-HFPO-DA | | 95 | 20-150 |
| 13C3-PFBS | | 95 | 20-150 |
| 13C3-PFHxS | | 91 | 20-150 |
| 13C4-PFBA | | 99 | 20-150 |
| 13C4-PFHpA | | 95 | 20-150 |
| 13C5-PFHxA | | 99 | 20-150 |
| 13C5-PFPeA | M-03 | 102 | 20-150 |
| 13C6-PFDA | M-03 | 101 | 20-150 |
| 13C7-PFUnA | | 91 | 20-150 |
| 13C8-PFOA | | 91 | 20-150 |
| 13C8-PFOS | | 99 | 20-150 |
| 13C8-PFOSA | | 97 | 20-150 |
| 13C9-PFNA | | 92 | 20-150 |
| D3-NMeFOSA | | 86 | 20-150 |
| D3-NMeFOSAA | | 92 | 20-150 |
| D5-NEtFOSA | | 89 | 20-150 |
| D5-NEtFOSAA | | 89 | 20-150 |
| D7-NMeFOSE | | 95 | 20-150 |
| D9-NEtFOSE | | 92 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-006

Description: VRTB-L-M5_04012024 | Matrix: Aqueous

Date Sampled: 04/01/2024 1740 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0353 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 5 | 05/02/2024 2331 | BWS | 04/24/2024 1716 | 10620 |
| 3 | 1633 | 1633 | 1 | 05/07/2024 0449 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.83 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.63 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 34 | | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 83 | | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.94 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQ | 9.5 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQ | 9.5 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.2 | M-03 | 0.95 | 0.33 | 0.089 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 30 | M-03 | 3.8 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.25 | JM-03 | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 64 | | 0.95 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 82 | | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 730 | EM-03 | 0.95 | 0.69 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 74 | | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.95 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 86 | M-03 | 0.95 | 0.38 | 0.098 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.0 | M-03 | 0.95 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 9900 | EM-03 | 0.95 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 130 | M-03 | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 13 | M-03 | 0.95 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 83 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.56 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.76 | UQ | 0.95 | 0.76 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-006
Description: VRTB-L-M5_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1740 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 121 | 20-150 | M-03 | 98 | 20-150 | H | 76 | 20-150 |
| 13C2-6:2FTS | | 111 | 20-150 | M-03 | 101 | 20-150 | H | 73 | 20-150 |
| 13C2-8:2FTS | | 105 | 20-150 | M-03 | 102 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | | 74 | 20-150 | M-03 | 75 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | N | 8.0 | 20-150 | N | 8.0 | 20-150 | H | 71 | 20-150 |
| 13C3-HFPO-DA | | 104 | 20-150 | | 106 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 112 | 20-150 | | 103 | 20-150 | H | 74 | 20-150 |
| 13C3-PFHxS | | 107 | 20-150 | M-03 | 103 | 20-150 | H | 79 | 20-150 |
| 13C4-PFBA | | 107 | 20-150 | | 107 | 20-150 | H | 79 | 20-150 |
| 13C4-PFHpA | | 100 | 20-150 | | 111 | 20-150 | H | 79 | 20-150 |
| 13C5-PFHxA | | 106 | 20-150 | | 102 | 20-150 | H | 79 | 20-150 |
| 13C5-PFPeA | | 106 | 20-150 | | 106 | 20-150 | H | 80 | 20-150 |
| 13C6-PFDA | | 101 | 20-150 | | 99 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 91 | 20-150 | | 99 | 20-150 | H | 80 | 20-150 |
| 13C8-PFOA | | 92 | 20-150 | | 82 | 20-150 | H | 85 | 20-150 |
| 13C8-PFOS | M-03 | 102 | 20-150 | M-03 | 111 | 20-150 | H | 78 | 20-150 |
| 13C8-PFOSA | | 145 | 20-150 | | 119 | 20-150 | H | 80 | 20-150 |
| 13C9-PFNA | | 108 | 20-150 | M-03 | 109 | 20-150 | H | 76 | 20-150 |
| D3-NMeFOSA | | 106 | 20-150 | | 93 | 20-150 | H | 54 | 20-150 |
| D3-NMeFOSAA | | 128 | 20-150 | M-03 | 110 | 20-150 | H | 83 | 20-150 |
| D5-NEtFOSA | | 92 | 20-150 | | 70 | 20-150 | H | 55 | 20-150 |
| D5-NEtFOSAA | M-03 | 113 | 20-150 | M-03 | 82 | 20-150 | H | 81 | 20-150 |
| D7-NMeFOSE | N | 4.0 | 20-150 | N | 3.0 | 20-150 | H | 74 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 74 | 20-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-006
Description: VRTB-L-M5_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1740 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0353 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 5 | 05/02/2024 2331 | BWS | 04/24/2024 1716 | 10620 |
| 3 | 1633 | 1633 | 1 | 05/07/2024 0449 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.1 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.2 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.1 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 33 | | 19 | 7.1 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 79 | M-03 | 24 | 22 | 9.6 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.7 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.61 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.4 | UQ | 47 | 9.4 | 2.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.4 | UQ | 47 | 9.4 | 3.0 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.2 | U | 9.5 | 6.2 | 2.7 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.2 | U | 9.5 | 5.2 | 1.7 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.0 | U | 9.5 | 3.0 | 0.87 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.2 | U | 9.5 | 6.2 | 1.8 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 4.6 | JM-03 | 4.7 | 1.6 | 0.44 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 30 | M-03 | 19 | 7.6 | 2.4 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.78 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.64 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.73 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.51 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 51 | M-03 | 4.7 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 76 | | 4.7 | 3.8 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 650 | M-03 | 4.7 | 3.4 | 0.87 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 78 | | 4.7 | 1.9 | 0.67 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.69 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 82 | M-03 | 4.7 | 1.9 | 0.49 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.0 | JM-03 | 4.7 | 1.9 | 0.94 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 8800 | EM-03 | 4.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 130 | M-03 | 4.7 | 3.8 | 0.99 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 13 | | 4.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 81 | M-03 | 9.5 | 1.9 | 0.87 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.8 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.8 | UQ | 4.7 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.92 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-006
Description: VRTB-L-M5_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1740
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 121 | 20-150 | M-03 | 98 | 20-150 | H | 76 | 20-150 |
| 13C2-6:2FTS | | 111 | 20-150 | M-03 | 101 | 20-150 | H | 73 | 20-150 |
| 13C2-8:2FTS | | 105 | 20-150 | M-03 | 102 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | | 74 | 20-150 | M-03 | 75 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | N | 8.0 | 20-150 | N | 8.0 | 20-150 | H | 71 | 20-150 |
| 13C3-HFPO-DA | | 104 | 20-150 | | 106 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 112 | 20-150 | | 103 | 20-150 | H | 74 | 20-150 |
| 13C3-PFHxS | | 107 | 20-150 | M-03 | 103 | 20-150 | H | 79 | 20-150 |
| 13C4-PFBA | | 107 | 20-150 | | 107 | 20-150 | H | 79 | 20-150 |
| 13C4-PFHpA | | 100 | 20-150 | | 111 | 20-150 | H | 79 | 20-150 |
| 13C5-PFHxA | | 106 | 20-150 | | 102 | 20-150 | H | 79 | 20-150 |
| 13C5-PFPeA | | 106 | 20-150 | | 106 | 20-150 | H | 80 | 20-150 |
| 13C6-PFDA | | 101 | 20-150 | | 99 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 91 | 20-150 | | 99 | 20-150 | H | 80 | 20-150 |
| 13C8-PFOA | | 92 | 20-150 | | 82 | 20-150 | H | 85 | 20-150 |
| 13C8-PFOS | M-03 | 102 | 20-150 | M-03 | 111 | 20-150 | H | 78 | 20-150 |
| 13C8-PFOSA | | 145 | 20-150 | | 119 | 20-150 | H | 80 | 20-150 |
| 13C9-PFNA | | 108 | 20-150 | M-03 | 109 | 20-150 | H | 76 | 20-150 |
| D3-NMeFOSA | | 106 | 20-150 | | 93 | 20-150 | H | 54 | 20-150 |
| D3-NMeFOSAA | | 128 | 20-150 | M-03 | 110 | 20-150 | H | 83 | 20-150 |
| D5-NEtFOSA | | 92 | 20-150 | | 70 | 20-150 | H | 55 | 20-150 |
| D5-NEtFOSAA | M-03 | 113 | 20-150 | M-03 | 82 | 20-150 | H | 81 | 20-150 |
| D7-NMeFOSE | N | 4.0 | 20-150 | N | 3.0 | 20-150 | H | 74 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 74 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-006
Description: VRTB-L-M5_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1740 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0353 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 5 | 05/02/2024 2331 | BWS | 04/24/2024 1716 | 10620 |
| 3 | 1633 | 1633 | 1 | 05/07/2024 0449 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 75 | UH | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 110 | HJM-03 | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 8.1 | HJM-03 | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 41 | HJM-03 | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 56 | HM-03 | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 100 | HM-03 | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 820 | BHM-03 | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 96 | HM-03 | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 100 | H | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 11000 | BHM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 130 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 38 | UH | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 100 | HM-03 | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-006
Description: VRTB-L-M5_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1740
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 121 | 20-150 | M-03 | 98 | 20-150 | H | 76 | 20-150 |
| 13C2-6:2FTS | | 111 | 20-150 | M-03 | 101 | 20-150 | H | 73 | 20-150 |
| 13C2-8:2FTS | | 105 | 20-150 | M-03 | 102 | 20-150 | H | 67 | 20-150 |
| 13C2-PFDoA | | 74 | 20-150 | M-03 | 75 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | N | 8.0 | 20-150 | N | 8.0 | 20-150 | H | 71 | 20-150 |
| 13C3-HFPO-DA | | 104 | 20-150 | | 106 | 20-150 | H | 78 | 20-150 |
| 13C3-PFBS | | 112 | 20-150 | | 103 | 20-150 | H | 74 | 20-150 |
| 13C3-PFHxS | | 107 | 20-150 | M-03 | 103 | 20-150 | H | 79 | 20-150 |
| 13C4-PFBA | | 107 | 20-150 | | 107 | 20-150 | H | 79 | 20-150 |
| 13C4-PFHpA | | 100 | 20-150 | | 111 | 20-150 | H | 79 | 20-150 |
| 13C5-PFHxA | | 106 | 20-150 | | 102 | 20-150 | H | 79 | 20-150 |
| 13C5-PFPeA | | 106 | 20-150 | | 106 | 20-150 | H | 80 | 20-150 |
| 13C6-PFDA | | 101 | 20-150 | | 99 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 91 | 20-150 | | 99 | 20-150 | H | 80 | 20-150 |
| 13C8-PFOA | | 92 | 20-150 | | 82 | 20-150 | H | 85 | 20-150 |
| 13C8-PFOS | M-03 | 102 | 20-150 | M-03 | 111 | 20-150 | H | 78 | 20-150 |
| 13C8-PFOSA | | 145 | 20-150 | | 119 | 20-150 | H | 80 | 20-150 |
| 13C9-PFNA | | 108 | 20-150 | M-03 | 109 | 20-150 | H | 76 | 20-150 |
| D3-NMeFOSA | | 106 | 20-150 | | 93 | 20-150 | H | 54 | 20-150 |
| D3-NMeFOSAA | | 128 | 20-150 | M-03 | 110 | 20-150 | H | 83 | 20-150 |
| D5-NEtFOSA | | 92 | 20-150 | | 70 | 20-150 | H | 55 | 20-150 |
| D5-NEtFOSAA | M-03 | 113 | 20-150 | M-03 | 82 | 20-150 | H | 81 | 20-150 |
| D7-NMeFOSE | N | 4.0 | 20-150 | N | 3.0 | 20-150 | H | 74 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 74 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-007

Description: VRTB-L-06_04012024 | Matrix: Aqueous

Date Sampled: 04/01/2024 1825 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0402 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 5 | 05/02/2024 2340 | BWS | 04/24/2024 1716 | 10620 |
| 3 | 1633 | 1633 | 1 | 05/07/2024 0458 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.65 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 55 | | 3.9 | 1.5 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 140 | M-03 | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.96 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UQ | 9.6 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UQ | 9.6 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.56 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.7 | M-03 | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 46 | M-03 | 3.9 | 1.6 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.42 | JM-03 | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 99 | | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 150 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1100 | EM-03 | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 130 | M-03 | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 110 | M-03 | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.4 | QM-03 | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 15000 | EM-03 | 0.96 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 220 | M-03 | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 20 | M-03 | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 160 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | UQ | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-007
Description: VRTB-L-06_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1825 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 123 | 20-150 | | 103 | 20-150 | H | 62 | 20-150 |
| 13C2-6:2FTS | | 110 | 20-150 | M-03 | 106 | 20-150 | H | 58 | 20-150 |
| 13C2-8:2FTS | | 114 | 20-150 | M-03 | 104 | 20-150 | H | 59 | 20-150 |
| 13C2-PFDoA | | 92 | 20-150 | M-03 | 84 | 20-150 | H | 69 | 20-150 |
| 13C2-PFTeDA | N | 13 | 20-150 | M-03N | 14 | 20-150 | H | 67 | 20-150 |
| 13C3-HFPO-DA | | 103 | 20-150 | | 101 | 20-150 | H | 72 | 20-150 |
| 13C3-PFBS | | 123 | 20-150 | | 116 | 20-150 | H | 63 | 20-150 |
| 13C3-PFHxS | | 112 | 20-150 | | 106 | 20-150 | H | 63 | 20-150 |
| 13C4-PFBA | | 109 | 20-150 | | 112 | 20-150 | H | 69 | 20-150 |
| 13C4-PFHpA | | 102 | 20-150 | | 108 | 20-150 | H | 69 | 20-150 |
| 13C5-PFHxA | | 109 | 20-150 | | 107 | 20-150 | H | 69 | 20-150 |
| 13C5-PFPeA | | 114 | 20-150 | | 117 | 20-150 | H | 68 | 20-150 |
| 13C6-PFDA | | 110 | 20-150 | M-03 | 103 | 20-150 | H | 71 | 20-150 |
| 13C7-PFUnA | | 104 | 20-150 | | 97 | 20-150 | HM-03 | 78 | 20-150 |
| 13C8-PFOA | | 98 | 20-150 | M-03 | 110 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOS | | 105 | 20-150 | M-03 | 108 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOSA | N | 157 | 20-150 | | 117 | 20-150 | H | 68 | 20-150 |
| 13C9-PFNA | | 110 | 20-150 | M-03 | 118 | 20-150 | H | 69 | 20-150 |
| D3-NMeFOSA | | 133 | 20-150 | | 90 | 20-150 | H | 47 | 20-150 |
| D3-NMeFOSAA | | 138 | 20-150 | M-03 | 114 | 20-150 | H | 71 | 20-150 |
| D5-NEtFOSA | | 115 | 20-150 | | 77 | 20-150 | H | 45 | 20-150 |
| D5-NEtFOSAA | | 116 | 20-150 | | 78 | 20-150 | H | 67 | 20-150 |
| D7-NMeFOSE | N | 4.0 | 20-150 | M-03N | 2.0 | 20-150 | H | 62 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 61 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-007
Description: VRTB-L-06_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1825 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0402 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 5 | 05/02/2024 2340 | BWS | 04/24/2024 1716 | 10620 |
| 3 | 1633 | 1633 | 1 | 05/07/2024 0458 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.2 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.2 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.2 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 55 | | 19 | 7.1 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 130 | M-03 | 24 | 22 | 9.7 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 21 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.62 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.6 | UQ | 48 | 9.6 | 2.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.6 | UQ | 48 | 9.6 | 3.0 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.2 | U | 9.6 | 6.2 | 2.8 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.3 | U | 9.6 | 5.3 | 1.7 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.1 | U | 9.6 | 3.1 | 0.89 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.2 | U | 9.6 | 6.2 | 1.9 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.6 | M-03 | 4.8 | 1.7 | 0.45 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 46 | | 19 | 7.6 | 2.5 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.79 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.65 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.74 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.51 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 70 | M-03 | 4.8 | 1.8 | 0.92 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 150 | | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1100 | M-03 | 4.8 | 3.5 | 0.89 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 140 | | 4.8 | 1.9 | 0.68 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.8 | U | 4.8 | 1.8 | 0.70 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 100 | M-03 | 4.8 | 1.9 | 0.50 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.4 | JM-03 | 4.8 | 1.9 | 0.96 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 13000 | EM-03 | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 180 | M-03 | 4.8 | 3.8 | 1.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 19 | | 4.8 | 3.6 | 1.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 150 | M-03 | 9.6 | 1.9 | 0.89 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.9 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.8 | UQ | 4.8 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.94 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.8 | U | 4.8 | 3.8 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-007
Description: VRTB-L-06_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1825
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 123 | 20-150 | | 103 | 20-150 | H | 62 | 20-150 |
| 13C2-6:2FTS | | 110 | 20-150 | M-03 | 106 | 20-150 | H | 58 | 20-150 |
| 13C2-8:2FTS | | 114 | 20-150 | M-03 | 104 | 20-150 | H | 59 | 20-150 |
| 13C2-PFDoA | | 92 | 20-150 | M-03 | 84 | 20-150 | H | 69 | 20-150 |
| 13C2-PFTeDA | N | 13 | 20-150 | M-03N | 14 | 20-150 | H | 67 | 20-150 |
| 13C3-HFPO-DA | | 103 | 20-150 | | 101 | 20-150 | H | 72 | 20-150 |
| 13C3-PFBS | | 123 | 20-150 | | 116 | 20-150 | H | 63 | 20-150 |
| 13C3-PFHxS | | 112 | 20-150 | | 106 | 20-150 | H | 63 | 20-150 |
| 13C4-PFBA | | 109 | 20-150 | | 112 | 20-150 | H | 69 | 20-150 |
| 13C4-PFHpA | | 102 | 20-150 | | 108 | 20-150 | H | 69 | 20-150 |
| 13C5-PFHxA | | 109 | 20-150 | | 107 | 20-150 | H | 69 | 20-150 |
| 13C5-PFPeA | | 114 | 20-150 | | 117 | 20-150 | H | 68 | 20-150 |
| 13C6-PFDA | | 110 | 20-150 | M-03 | 103 | 20-150 | H | 71 | 20-150 |
| 13C7-PFUnA | | 104 | 20-150 | | 97 | 20-150 | HM-03 | 78 | 20-150 |
| 13C8-PFOA | | 98 | 20-150 | M-03 | 110 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOS | | 105 | 20-150 | M-03 | 108 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOSA | N | 157 | 20-150 | | 117 | 20-150 | H | 68 | 20-150 |
| 13C9-PFNA | | 110 | 20-150 | M-03 | 118 | 20-150 | H | 69 | 20-150 |
| D3-NMeFOSA | | 133 | 20-150 | | 90 | 20-150 | H | 47 | 20-150 |
| D3-NMeFOSAA | | 138 | 20-150 | M-03 | 114 | 20-150 | H | 71 | 20-150 |
| D5-NEtFOSA | | 115 | 20-150 | | 77 | 20-150 | H | 45 | 20-150 |
| D5-NEtFOSAA | | 116 | 20-150 | | 78 | 20-150 | H | 67 | 20-150 |
| D7-NMeFOSE | N | 4.0 | 20-150 | M-03N | 2.0 | 20-150 | H | 62 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 61 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-007
Description: VRTB-L-06_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1825 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0402 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 5 | 05/02/2024 2340 | BWS | 04/24/2024 1716 | 10620 |
| 3 | 1633 | 1633 | 1 | 05/07/2024 0458 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | UH | 400 | 230 | 87 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | UH | 400 | 220 | 67 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | UH | 400 | 230 | 66 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 150 | UH | 400 | 150 | 61 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | UH | 400 | 150 | 40 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 460 | UHM-03 | 500 | 460 | 200 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | UH | 2500 | 1000 | 430 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | UH | 400 | 240 | 99 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | UH | 100 | 40 | 13 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | UH | 1000 | 200 | 61 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | UH | 100 | 80 | 22 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | UH | 1000 | 200 | 63 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | UH | 200 | 130 | 58 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | UH | 200 | 110 | 36 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | UH | 200 | 64 | 18 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | UH | 200 | 130 | 39 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 14 | HJM-03 | 100 | 35 | 9.4 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 67 | HJ | 400 | 160 | 51 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | UH | 100 | 39 | 16 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | UH | 100 | 40 | 14 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | UH | 100 | 39 | 15 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | UH | 100 | 40 | 11 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 78 | HJM-03 | 100 | 38 | 19 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 170 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | UH | 2500 | 1000 | 420 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1300 | BHM-03 | 100 | 73 | 18 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 170 | HM-03 | 100 | 40 | 14 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | UH | 100 | 38 | 15 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 180 | HM-03 | 100 | 40 | 10 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 40 | UH | 100 | 40 | 20 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 17000 | BHM-03 | 100 | 74 | 25 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 250 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 75 | UHM-03 | 100 | 75 | 26 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 200 | H | 200 | 40 | 18 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | UH | 500 | 200 | 60 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | UH | 100 | 80 | 27 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | UH | 100 | 40 | 19 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | UH | 100 | 80 | 25 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-007
Description: VRTB-L-06_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1825
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 123 | 20-150 | | 103 | 20-150 | H | 62 | 20-150 |
| 13C2-6:2FTS | | 110 | 20-150 | M-03 | 106 | 20-150 | H | 58 | 20-150 |
| 13C2-8:2FTS | | 114 | 20-150 | M-03 | 104 | 20-150 | H | 59 | 20-150 |
| 13C2-PFDoA | | 92 | 20-150 | M-03 | 84 | 20-150 | H | 69 | 20-150 |
| 13C2-PFTeDA | N | 13 | 20-150 | M-03N | 14 | 20-150 | H | 67 | 20-150 |
| 13C3-HFPO-DA | | 103 | 20-150 | | 101 | 20-150 | H | 72 | 20-150 |
| 13C3-PFBS | | 123 | 20-150 | | 116 | 20-150 | H | 63 | 20-150 |
| 13C3-PFHxS | | 112 | 20-150 | | 106 | 20-150 | H | 63 | 20-150 |
| 13C4-PFBA | | 109 | 20-150 | | 112 | 20-150 | H | 69 | 20-150 |
| 13C4-PFHpA | | 102 | 20-150 | | 108 | 20-150 | H | 69 | 20-150 |
| 13C5-PFHxA | | 109 | 20-150 | | 107 | 20-150 | H | 69 | 20-150 |
| 13C5-PFPeA | | 114 | 20-150 | | 117 | 20-150 | H | 68 | 20-150 |
| 13C6-PFDA | | 110 | 20-150 | M-03 | 103 | 20-150 | H | 71 | 20-150 |
| 13C7-PFUnA | | 104 | 20-150 | | 97 | 20-150 | HM-03 | 78 | 20-150 |
| 13C8-PFOA | | 98 | 20-150 | M-03 | 110 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOS | | 105 | 20-150 | M-03 | 108 | 20-150 | H | 68 | 20-150 |
| 13C8-PFOSA | N | 157 | 20-150 | | 117 | 20-150 | H | 68 | 20-150 |
| 13C9-PFNA | | 110 | 20-150 | M-03 | 118 | 20-150 | H | 69 | 20-150 |
| D3-NMeFOSA | | 133 | 20-150 | | 90 | 20-150 | H | 47 | 20-150 |
| D3-NMeFOSAA | | 138 | 20-150 | M-03 | 114 | 20-150 | H | 71 | 20-150 |
| D5-NEtFOSA | | 115 | 20-150 | | 77 | 20-150 | H | 45 | 20-150 |
| D5-NEtFOSAA | | 116 | 20-150 | | 78 | 20-150 | H | 67 | 20-150 |
| D7-NMeFOSE | N | 4.0 | 20-150 | M-03N | 2.0 | 20-150 | H | 62 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 61 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-008
Description: VRTB-L-P7_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1925
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0412 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 5 | 05/02/2024 2349 | BWS | 04/24/2024 1716 | 10620 |
| 3 | 1633 | 1633 | 1 | 05/07/2024 0507 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.77 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 37 | | 3.5 | 1.3 | 0.53 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 140 | | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.87 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UQ | 8.8 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | UQ | 8.8 | 1.8 | 0.55 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 11 | M-03 | 0.88 | 0.31 | 0.082 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 57 | M-03 | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.094 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 140 | | 0.88 | 0.33 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 190 | | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1500 | EM-03 | 0.88 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 190 | M-03 | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.33 | U | 0.88 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 73 | M-03 | 0.88 | 0.35 | 0.090 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.9 | M-03 | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 16000 | EM-03 | 0.88 | 0.65 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 260 | M-03 | 0.88 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 39 | M-03 | 0.88 | 0.66 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 160 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.5 | JM-03 | 4.4 | 1.8 | 0.52 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | UQ | 0.88 | 0.70 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-008
Description: VRTB-L-P7_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1925
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | M-03 | 135 | 20-150 | | 106 | 20-150 | H | 84 | 20-150 |
| 13C2-6:2FTS | | 117 | 20-150 | M-03 | 98 | 20-150 | H | 88 | 20-150 |
| 13C2-8:2FTS | | 117 | 20-150 | M-03 | 99 | 20-150 | H | 74 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 | | 64 | 20-150 | H | 80 | 20-150 |
| 13C2-PFTeDA | N | 5.0 | 20-150 | N | 5.0 | 20-150 | H | 82 | 20-150 |
| 13C3-HFPO-DA | | 109 | 20-150 | | 106 | 20-150 | H | 90 | 20-150 |
| 13C3-PFBS | | 128 | 20-150 | | 106 | 20-150 | H | 84 | 20-150 |
| 13C3-PFHxS | | 110 | 20-150 | | 102 | 20-150 | H | 83 | 20-150 |
| 13C4-PFBA | | 104 | 20-150 | | 106 | 20-150 | H | 85 | 20-150 |
| 13C4-PFHpA | | 102 | 20-150 | | 108 | 20-150 | H | 83 | 20-150 |
| 13C5-PFHxA | | 112 | 20-150 | | 101 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 108 | 20-150 | | 109 | 20-150 | H | 86 | 20-150 |
| 13C6-PFDA | | 97 | 20-150 | M-03 | 94 | 20-150 | H | 79 | 20-150 |
| 13C7-PFUnA | | 88 | 20-150 | | 84 | 20-150 | H | 80 | 20-150 |
| 13C8-PFOA | | 90 | 20-150 | | 85 | 20-150 | H | 87 | 20-150 |
| 13C8-PFOS | | 87 | 20-150 | M-03 | 110 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOSA | | 140 | 20-150 | | 111 | 20-150 | H | 81 | 20-150 |
| 13C9-PFNA | | 105 | 20-150 | | 92 | 20-150 | H | 91 | 20-150 |
| D3-NMeFOSA | | 104 | 20-150 | M-03 | 85 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | | 115 | 20-150 | M-03 | 91 | 20-150 | H | 82 | 20-150 |
| D5-NEtFOSA | | 90 | 20-150 | | 70 | 20-150 | H | 60 | 20-150 |
| D5-NEtFOSAA | | 80 | 20-150 | | 74 | 20-150 | H | 84 | 20-150 |
| D7-NMeFOSE | N | 2.0 | 20-150 | N | 2.0 | 20-150 | H | 75 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 73 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-008
Description: VRTB-L-P7_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1925 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0412 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 5 | 05/02/2024 2349 | BWS | 04/24/2024 1716 | 10620 |
| 3 | 1633 | 1633 | 1 | 05/07/2024 0507 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 10 | U | 18 | 10 | 3.8 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 9.9 | U | 18 | 9.9 | 2.9 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 10 | U | 18 | 10 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 35 | M-03 | 18 | 6.8 | 2.7 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 6.8 | U | 18 | 6.8 | 1.7 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 140 | | 22 | 20 | 8.9 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 44 | U | 110 | 44 | 19 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 18 | 11 | 4.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.56 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.5 | U | 4.4 | 3.5 | 1.3 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 8.8 | UQ | 44 | 8.8 | 2.7 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.5 | U | 4.4 | 3.5 | 0.94 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.5 | U | 4.4 | 3.5 | 1.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 8.8 | UQ | 44 | 8.8 | 2.8 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 5.7 | U | 8.8 | 5.7 | 2.5 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 4.8 | U | 8.8 | 4.8 | 1.6 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 2.8 | U | 8.8 | 2.8 | 0.81 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 5.7 | U | 8.8 | 5.7 | 1.7 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 11 | M-03 | 4.4 | 1.5 | 0.41 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 54 | | 18 | 7.2 | 2.2 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.7 | U | 4.4 | 1.7 | 0.72 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.59 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.7 | U | 4.4 | 1.7 | 0.68 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.47 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 91 | | 4.4 | 1.7 | 0.83 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 170 | | 4.4 | 3.5 | 0.93 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 44 | U | 110 | 44 | 18 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1300 | M-03 | 4.4 | 3.2 | 0.81 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 200 | M-03 | 4.4 | 1.8 | 0.62 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.7 | U | 4.4 | 1.7 | 0.64 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 71 | M-03 | 4.4 | 1.8 | 0.45 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.0 | JM-03 | 4.4 | 1.8 | 0.87 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 13000 | EM-03 | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 270 | M-03 | 4.4 | 3.5 | 0.92 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 32 | M-03 | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 150 | | 8.8 | 1.8 | 0.81 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 8.8 | U | 22 | 8.8 | 2.6 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.5 | UQ | 4.4 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.85 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.5 | U | 4.4 | 3.5 | 1.1 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-008
Description: VRTB-L-P7_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 1925
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | M-03 | 135 | 20-150 | | 106 | 20-150 | H | 84 | 20-150 |
| 13C2-6:2FTS | | 117 | 20-150 | M-03 | 98 | 20-150 | H | 88 | 20-150 |
| 13C2-8:2FTS | | 117 | 20-150 | M-03 | 99 | 20-150 | H | 74 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 | | 64 | 20-150 | H | 80 | 20-150 |
| 13C2-PFTeDA | N | 5.0 | 20-150 | N | 5.0 | 20-150 | H | 82 | 20-150 |
| 13C3-HFPO-DA | | 109 | 20-150 | | 106 | 20-150 | H | 90 | 20-150 |
| 13C3-PFBS | | 128 | 20-150 | | 106 | 20-150 | H | 84 | 20-150 |
| 13C3-PFHxS | | 110 | 20-150 | | 102 | 20-150 | H | 83 | 20-150 |
| 13C4-PFBA | | 104 | 20-150 | | 106 | 20-150 | H | 85 | 20-150 |
| 13C4-PFHpA | | 102 | 20-150 | | 108 | 20-150 | H | 83 | 20-150 |
| 13C5-PFHxA | | 112 | 20-150 | | 101 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 108 | 20-150 | | 109 | 20-150 | H | 86 | 20-150 |
| 13C6-PFDA | | 97 | 20-150 | M-03 | 94 | 20-150 | H | 79 | 20-150 |
| 13C7-PFUnA | | 88 | 20-150 | | 84 | 20-150 | H | 80 | 20-150 |
| 13C8-PFOA | | 90 | 20-150 | | 85 | 20-150 | H | 87 | 20-150 |
| 13C8-PFOS | | 87 | 20-150 | M-03 | 110 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOSA | | 140 | 20-150 | | 111 | 20-150 | H | 81 | 20-150 |
| 13C9-PFNA | | 105 | 20-150 | | 92 | 20-150 | H | 91 | 20-150 |
| D3-NMeFOSA | | 104 | 20-150 | M-03 | 85 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | | 115 | 20-150 | M-03 | 91 | 20-150 | H | 82 | 20-150 |
| D5-NEtFOSA | | 90 | 20-150 | | 70 | 20-150 | H | 60 | 20-150 |
| D5-NEtFOSAA | | 80 | 20-150 | | 74 | 20-150 | H | 84 | 20-150 |
| D7-NMeFOSE | N | 2.0 | 20-150 | N | 2.0 | 20-150 | H | 75 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 73 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-008
Description: VRTB-L-P7_04012024 | Matrix: Aqueous
Date Sampled: 04/01/2024 1925 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0412 | BWS | 04/24/2024 1716 | 10620 |
| 2 | 1633 | 1633 | 5 | 05/02/2024 2349 | BWS | 04/24/2024 1716 | 10620 |
| 3 | 1633 | 1633 | 1 | 05/07/2024 0507 | BWS | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 66 | HJM-03 | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 130 | HJM-03 | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 23 | HJM-03 | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 70 | HJM-03 | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 120 | HM-03 | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 200 | HM-03 | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2000 | BHM-03 | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 210 | H | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 83 | HM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UHM-03 | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 20000 | BHM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 320 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 51 | HM-03 | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 160 | HM-03 | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-008

Description: VRTB-L-P7_04012024 | Matrix: Aqueous

Date Sampled: 04/01/2024 1925 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | M-03 | 135 | 20-150 | | 106 | 20-150 | H | 84 | 20-150 |
| 13C2-6:2FTS | | 117 | 20-150 | M-03 | 98 | 20-150 | H | 88 | 20-150 |
| 13C2-8:2FTS | | 117 | 20-150 | M-03 | 99 | 20-150 | H | 74 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 | | 64 | 20-150 | H | 80 | 20-150 |
| 13C2-PFTeDA | N | 5.0 | 20-150 | N | 5.0 | 20-150 | H | 82 | 20-150 |
| 13C3-HFPO-DA | | 109 | 20-150 | | 106 | 20-150 | H | 90 | 20-150 |
| 13C3-PFBS | | 128 | 20-150 | | 106 | 20-150 | H | 84 | 20-150 |
| 13C3-PFHxS | | 110 | 20-150 | | 102 | 20-150 | H | 83 | 20-150 |
| 13C4-PFBA | | 104 | 20-150 | | 106 | 20-150 | H | 85 | 20-150 |
| 13C4-PFHpA | | 102 | 20-150 | | 108 | 20-150 | H | 83 | 20-150 |
| 13C5-PFHxA | | 112 | 20-150 | | 101 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 108 | 20-150 | | 109 | 20-150 | H | 86 | 20-150 |
| 13C6-PFDA | | 97 | 20-150 | M-03 | 94 | 20-150 | H | 79 | 20-150 |
| 13C7-PFUnA | | 88 | 20-150 | | 84 | 20-150 | H | 80 | 20-150 |
| 13C8-PFOA | | 90 | 20-150 | | 85 | 20-150 | H | 87 | 20-150 |
| 13C8-PFOS | | 87 | 20-150 | M-03 | 110 | 20-150 | H | 82 | 20-150 |
| 13C8-PFOSA | | 140 | 20-150 | | 111 | 20-150 | H | 81 | 20-150 |
| 13C9-PFNA | | 105 | 20-150 | | 92 | 20-150 | H | 91 | 20-150 |
| D3-NMeFOSA | | 104 | 20-150 | M-03 | 85 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | | 115 | 20-150 | M-03 | 91 | 20-150 | H | 82 | 20-150 |
| D5-NEtFOSA | | 90 | 20-150 | | 70 | 20-150 | H | 60 | 20-150 |
| D5-NEtFOSAA | | 80 | 20-150 | | 74 | 20-150 | H | 84 | 20-150 |
| D7-NMeFOSE | N | 2.0 | 20-150 | N | 2.0 | 20-150 | H | 75 | 20-150 |
| D9-NEtFOSE | N | 1.0 | 20-150 | N | 1.0 | 20-150 | H | 73 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-009
Description: VRTB-L-BB8_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 2005
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1811 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 10 | 04/29/2024 1858 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1217 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.86 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.9 | 2.1 | 0.66 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.9 | 2.2 | 0.65 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 18 | M-03 | 3.9 | 1.5 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.5 | U | 3.9 | 1.5 | 0.39 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 140 | | 4.9 | 4.5 | 2.0 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.2 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.9 | 2.3 | 0.97 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.29 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 9.8 | 2.0 | 0.60 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.29 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 9.8 | 2.0 | 0.62 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.57 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.1 | U | 2.0 | 1.1 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.64 | U | 2.0 | 0.64 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.3 | U | 2.0 | 1.3 | 0.38 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 26 | | 0.98 | 0.34 | 0.092 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 120 | | 3.9 | 1.6 | 0.50 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.38 | U | 0.98 | 0.38 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.38 | U | 0.98 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 200 | M-03 | 0.98 | 0.37 | 0.19 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 380 | | 0.98 | 0.78 | 0.21 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 3300 | EM-03 | 0.98 | 0.72 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 430 | | 0.98 | 0.39 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.37 | U | 0.98 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 100 | M-03 | 0.98 | 0.39 | 0.10 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.4 | M-03 | 0.98 | 0.39 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 18000 | BELM-03 | 0.98 | 0.73 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 410 | M-03 | 0.98 | 0.78 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 91 | | 0.98 | 0.74 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 320 | | 2.0 | 0.40 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.0 | U | 4.9 | 2.0 | 0.58 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.39 | U | 0.98 | 0.39 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.78 | U | 0.98 | 0.78 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-009
Description: VRTB-L-BB8_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 2005
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | | 76 | 20-150 | H | 92 | 20-150 |
| 13C2-6:2FTS | | 93 | 20-150 | | 72 | 20-150 | H | 98 | 20-150 |
| 13C2-8:2FTS | | 91 | 20-150 | | 88 | 20-150 | H | 87 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 | M-03 | 75 | 20-150 | H | 79 | 20-150 |
| 13C2-PFTeDA | | 70 | 20-150 | | 70 | 20-150 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 | | 81 | 20-150 | H | 89 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 | | 85 | 20-150 | H | 94 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 | | 77 | 20-150 | H | 94 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | | 90 | 20-150 | H | 90 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 | | 80 | 20-150 | H | 89 | 20-150 |
| 13C5-PFHxA | | 87 | 20-150 | M-03 | 91 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 | | 86 | 20-150 | H | 90 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | M-03 | 82 | 20-150 | H | 91 | 20-150 |
| 13C7-PFUnA | | 81 | 20-150 | M-03 | 83 | 20-150 | H | 87 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 | | 76 | 20-150 | H | 91 | 20-150 |
| 13C8-PFOS | M-03 | 88 | 20-150 | M-03 | 73 | 20-150 | H | 89 | 20-150 |
| 13C8-PFOSA | | 116 | 20-150 | | 79 | 20-150 | H | 83 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | M-03 | 85 | 20-150 | H | 83 | 20-150 |
| D3-NMeFOSA | | 109 | 20-150 | | 69 | 20-150 | H | 61 | 20-150 |
| D3-NMeFOSAA | | 122 | 20-150 | M-03 | 85 | 20-150 | H | 77 | 20-150 |
| D5-NEtFOSA | | 107 | 20-150 | | 79 | 20-150 | H | 61 | 20-150 |
| D5-NEtFOSAA | | 100 | 20-150 | | 83 | 20-150 | H | 72 | 20-150 |
| D7-NMeFOSE | | 113 | 20-150 | | 77 | 20-150 | H | 72 | 20-150 |
| D9-NEtFOSE | | 112 | 20-150 | | 75 | 20-150 | H | 73 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-009

Description: VRTB-L-BB8_04012024 | Matrix: Aqueous

Date Sampled: 04/01/2024 2005 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1811 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 10 | 04/29/2024 1858 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1217 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 22 | U | 39 | 22 | 8.6 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 21 | U | 39 | 21 | 6.6 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 22 | U | 39 | 22 | 6.5 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 19 | JM-03 | 39 | 15 | 6.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 15 | U | 39 | 15 | 3.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 150 | | 49 | 45 | 20 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 96 | U | 240 | 96 | 42 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 23 | U | 39 | 23 | 9.7 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.9 | U | 9.8 | 3.9 | 1.3 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.8 | U | 9.8 | 7.8 | 2.9 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 20 | U | 98 | 20 | 6.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.8 | U | 9.8 | 7.8 | 2.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.8 | U | 9.8 | 7.8 | 2.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 20 | U | 98 | 20 | 6.2 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 13 | U | 20 | 13 | 5.7 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 11 | U | 20 | 11 | 3.5 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 6.4 | U | 20 | 6.4 | 1.8 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 13 | U | 20 | 13 | 3.8 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 25 | M-03 | 9.8 | 3.4 | 0.92 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 120 | | 39 | 16 | 5.0 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.8 | U | 9.8 | 3.8 | 1.6 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.9 | U | 9.8 | 3.9 | 1.3 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.8 | U | 9.8 | 3.8 | 1.5 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.9 | U | 9.8 | 3.9 | 1.0 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 160 | | 9.8 | 3.7 | 1.9 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 390 | | 9.8 | 7.8 | 2.1 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 96 | U | 240 | 96 | 41 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 3400 | M-03 | 9.8 | 7.2 | 1.8 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 400 | | 9.8 | 3.9 | 1.4 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.7 | U | 9.8 | 3.7 | 1.4 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 95 | M-03 | 9.8 | 3.9 | 1.0 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.9 | U | 9.8 | 3.9 | 1.9 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 19000 | BELM-03 | 9.8 | 7.3 | 2.4 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 390 | M-03 | 9.8 | 7.8 | 2.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 80 | M-03 | 9.8 | 7.4 | 2.5 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 320 | | 20 | 4.0 | 1.8 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 20 | U | 49 | 20 | 5.8 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.8 | U | 9.8 | 7.8 | 2.6 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.9 | U | 9.8 | 3.9 | 1.9 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.8 | U | 9.8 | 7.8 | 2.4 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-009
Description: VRTB-L-BB8_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 2005
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | | 76 | 20-150 | H | 92 | 20-150 |
| 13C2-6:2FTS | | 93 | 20-150 | | 72 | 20-150 | H | 98 | 20-150 |
| 13C2-8:2FTS | | 91 | 20-150 | | 88 | 20-150 | H | 87 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 | M-03 | 75 | 20-150 | H | 79 | 20-150 |
| 13C2-PFTeDA | | 70 | 20-150 | | 70 | 20-150 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 | | 81 | 20-150 | H | 89 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 | | 85 | 20-150 | H | 94 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 | | 77 | 20-150 | H | 94 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | | 90 | 20-150 | H | 90 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 | | 80 | 20-150 | H | 89 | 20-150 |
| 13C5-PFHxA | | 87 | 20-150 | M-03 | 91 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 | | 86 | 20-150 | H | 90 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | M-03 | 82 | 20-150 | H | 91 | 20-150 |
| 13C7-PFUnA | | 81 | 20-150 | M-03 | 83 | 20-150 | H | 87 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 | | 76 | 20-150 | H | 91 | 20-150 |
| 13C8-PFOS | M-03 | 88 | 20-150 | M-03 | 73 | 20-150 | H | 89 | 20-150 |
| 13C8-PFOSA | | 116 | 20-150 | | 79 | 20-150 | H | 83 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | M-03 | 85 | 20-150 | H | 83 | 20-150 |
| D3-NMeFOSA | | 109 | 20-150 | | 69 | 20-150 | H | 61 | 20-150 |
| D3-NMeFOSAA | | 122 | 20-150 | M-03 | 85 | 20-150 | H | 77 | 20-150 |
| D5-NEtFOSA | | 107 | 20-150 | | 79 | 20-150 | H | 61 | 20-150 |
| D5-NEtFOSAA | | 100 | 20-150 | | 83 | 20-150 | H | 72 | 20-150 |
| D7-NMeFOSE | | 113 | 20-150 | | 77 | 20-150 | H | 72 | 20-150 |
| D9-NEtFOSE | | 112 | 20-150 | | 75 | 20-150 | H | 73 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-009

Description: VRTB-L-BB8_04012024 | Matrix: Aqueous

Date Sampled: 04/01/2024 2005 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1811 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 10 | 04/29/2024 1858 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1217 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 75 | UH | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 110 | HJ | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 22 | HJM-03 | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 100 | HJ | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 110 | H | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 320 | H | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2700 | HM-03 | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 370 | HM-03 | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 72 | HM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 14000 | HM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 380 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 65 | HM-03 | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 260 | HM-03 | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-009
Description: VRTB-L-BB8_04012024
Matrix: Aqueous
Date Sampled: 04/01/2024 2005
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | | 76 | 20-150 | H | 92 | 20-150 |
| 13C2-6:2FTS | | 93 | 20-150 | | 72 | 20-150 | H | 98 | 20-150 |
| 13C2-8:2FTS | | 91 | 20-150 | | 88 | 20-150 | H | 87 | 20-150 |
| 13C2-PFDoA | | 78 | 20-150 | M-03 | 75 | 20-150 | H | 79 | 20-150 |
| 13C2-PFTeDA | | 70 | 20-150 | | 70 | 20-150 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 | | 81 | 20-150 | H | 89 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 | | 85 | 20-150 | H | 94 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 | | 77 | 20-150 | H | 94 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | | 90 | 20-150 | H | 90 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 | | 80 | 20-150 | H | 89 | 20-150 |
| 13C5-PFHxA | | 87 | 20-150 | M-03 | 91 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 | | 86 | 20-150 | H | 90 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | M-03 | 82 | 20-150 | H | 91 | 20-150 |
| 13C7-PFUnA | | 81 | 20-150 | M-03 | 83 | 20-150 | H | 87 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 | | 76 | 20-150 | H | 91 | 20-150 |
| 13C8-PFOS | M-03 | 88 | 20-150 | M-03 | 73 | 20-150 | H | 89 | 20-150 |
| 13C8-PFOSA | | 116 | 20-150 | | 79 | 20-150 | H | 83 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | M-03 | 85 | 20-150 | H | 83 | 20-150 |
| D3-NMeFOSA | | 109 | 20-150 | | 69 | 20-150 | H | 61 | 20-150 |
| D3-NMeFOSAA | | 122 | 20-150 | M-03 | 85 | 20-150 | H | 77 | 20-150 |
| D5-NEtFOSA | | 107 | 20-150 | | 79 | 20-150 | H | 61 | 20-150 |
| D5-NEtFOSAA | | 100 | 20-150 | | 83 | 20-150 | H | 72 | 20-150 |
| D7-NMeFOSE | | 113 | 20-150 | | 77 | 20-150 | H | 72 | 20-150 |
| D9-NEtFOSE | | 112 | 20-150 | | 75 | 20-150 | H | 73 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-010
Description: VRTB-S-M5_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1005 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1820 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1907 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1226 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.76 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.58 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 63 | | 3.5 | 1.3 | 0.53 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 86 | | 4.3 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.86 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.25 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.7 | U | 8.7 | 1.7 | 0.53 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.7 | U | 8.7 | 1.7 | 0.55 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.1 | U | 1.7 | 1.1 | 0.50 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.94 | U | 1.7 | 0.94 | 0.31 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.54 | U | 1.7 | 0.54 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.1 | U | 1.7 | 1.1 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.7 | M-03 | 0.87 | 0.30 | 0.082 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 27 | | 3.5 | 1.4 | 0.44 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.87 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | U | 0.87 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.093 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 70 | | 0.87 | 0.33 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 92 | | 0.87 | 0.70 | 0.18 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.6 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 880 | EM-03 | 0.87 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 87 | M-03 | 0.87 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.33 | U | 0.87 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 31 | M-03 | 0.87 | 0.35 | 0.090 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.87 | M-03 | 0.87 | 0.35 | 0.17 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 6700 | BELM-03 | 0.87 | 0.64 | 0.21 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 140 | M-03 | 0.87 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 22 | | 0.87 | 0.65 | 0.22 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 65 | | 1.7 | 0.34 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.7 | U | 4.3 | 1.7 | 0.52 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-010
Description: VRTB-S-M5_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1005
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 97 | 20-150 | M-03 | 76 | 20-150 | H | 89 | 20-150 |
| 13C2-6:2FTS | | 99 | 20-150 | | 72 | 20-150 | H | 92 | 20-150 |
| 13C2-8:2FTS | | 73 | 20-150 | | 71 | 20-150 | H | 80 | 20-150 |
| 13C2-PFDoA | | 68 | 20-150 | M-03 | 62 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | | 58 | 20-150 | | 60 | 20-150 | H | 74 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 84 | 20-150 | H | 88 | 20-150 |
| 13C3-PFBS | | 93 | 20-150 | M-03 | 78 | 20-150 | H | 94 | 20-150 |
| 13C3-PFHxS | | 87 | 20-150 | | 80 | 20-150 | H | 87 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 | | 85 | 20-150 | H | 89 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 | M-03 | 86 | 20-150 | H | 85 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | M-03 | 89 | 20-150 | H | 88 | 20-150 |
| 13C5-PFPeA | | 88 | 20-150 | | 85 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 80 | 20-150 | | 90 | 20-150 | H | 82 | 20-150 |
| 13C7-PFUnA | M-03 | 77 | 20-150 | M-03 | 73 | 20-150 | H | 81 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 | | 77 | 20-150 | H | 88 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | M-03 | 88 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOSA | | 103 | 20-150 | | 85 | 20-150 | H | 78 | 20-150 |
| 13C9-PFNA | | 92 | 20-150 | | 85 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 85 | 20-150 | | 76 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 111 | 20-150 | | 92 | 20-150 | H | 79 | 20-150 |
| D5-NEtFOSA | | 82 | 20-150 | | 79 | 20-150 | H | 61 | 20-150 |
| D5-NEtFOSAA | | 94 | 20-150 | M-03 | 101 | 20-150 | H | 78 | 20-150 |
| D7-NMeFOSE | | 87 | 20-150 | | 77 | 20-150 | H | 73 | 20-150 |
| D9-NEtFOSE | | 81 | 20-150 | | 71 | 20-150 | H | 72 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-010
Description: VRTB-S-M5_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1005 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1820 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1907 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1226 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 9.8 | U | 17 | 9.8 | 3.8 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 9.4 | U | 17 | 9.4 | 2.9 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 9.8 | U | 17 | 9.8 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 48 | M-03 | 17 | 6.4 | 2.6 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 6.4 | U | 17 | 6.4 | 1.7 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 110 | M-03 | 22 | 20 | 8.8 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 44 | U | 110 | 44 | 19 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 10 | U | 17 | 10 | 4.3 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.7 | U | 4.3 | 1.7 | 0.56 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.4 | U | 4.3 | 3.4 | 1.3 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 8.6 | U | 43 | 8.6 | 2.7 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.4 | U | 4.3 | 3.4 | 0.94 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.4 | U | 4.3 | 3.4 | 1.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 8.6 | U | 43 | 8.6 | 2.7 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 5.7 | U | 8.7 | 5.7 | 2.5 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 4.8 | U | 8.7 | 4.8 | 1.6 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 2.8 | U | 8.7 | 2.8 | 0.80 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 5.7 | U | 8.7 | 5.7 | 1.7 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.1 | | 4.3 | 1.5 | 0.41 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 22 | M-03 | 17 | 6.8 | 2.2 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.7 | U | 4.3 | 1.7 | 0.72 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.7 | U | 4.3 | 1.7 | 0.59 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.7 | U | 4.3 | 1.7 | 0.67 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.7 | U | 4.3 | 1.7 | 0.46 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 56 | M-03 | 4.3 | 1.6 | 0.83 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 86 | | 4.3 | 3.4 | 0.92 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 44 | U | 110 | 44 | 18 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 790 | M-03 | 4.3 | 3.1 | 0.80 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 82 | | 4.3 | 1.7 | 0.62 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.6 | U | 4.3 | 1.6 | 0.63 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 36 | M-03 | 4.3 | 1.7 | 0.45 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.7 | U | 4.3 | 1.7 | 0.86 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 6300 | BELM-03 | 4.3 | 3.2 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 160 | M-03 | 4.3 | 3.4 | 0.91 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 18 | M-03 | 4.3 | 3.2 | 1.1 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 63 | | 8.7 | 1.7 | 0.80 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 8.8 | U | 22 | 8.8 | 2.6 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.4 | U | 4.3 | 3.4 | 1.2 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.7 | U | 4.3 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.4 | U | 4.3 | 3.4 | 1.1 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-010
Description: VRTB-S-M5_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1005
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 97 | 20-150 | M-03 | 76 | 20-150 | H | 89 | 20-150 |
| 13C2-6:2FTS | | 99 | 20-150 | | 72 | 20-150 | H | 92 | 20-150 |
| 13C2-8:2FTS | | 73 | 20-150 | | 71 | 20-150 | H | 80 | 20-150 |
| 13C2-PFDoA | | 68 | 20-150 | M-03 | 62 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | | 58 | 20-150 | | 60 | 20-150 | H | 74 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 84 | 20-150 | H | 88 | 20-150 |
| 13C3-PFBS | | 93 | 20-150 | M-03 | 78 | 20-150 | H | 94 | 20-150 |
| 13C3-PFHxS | | 87 | 20-150 | | 80 | 20-150 | H | 87 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 | | 85 | 20-150 | H | 89 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 | M-03 | 86 | 20-150 | H | 85 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | M-03 | 89 | 20-150 | H | 88 | 20-150 |
| 13C5-PFPeA | | 88 | 20-150 | | 85 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 80 | 20-150 | | 90 | 20-150 | H | 82 | 20-150 |
| 13C7-PFUnA | M-03 | 77 | 20-150 | M-03 | 73 | 20-150 | H | 81 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 | | 77 | 20-150 | H | 88 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | M-03 | 88 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOSA | | 103 | 20-150 | | 85 | 20-150 | H | 78 | 20-150 |
| 13C9-PFNA | | 92 | 20-150 | | 85 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 85 | 20-150 | | 76 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 111 | 20-150 | | 92 | 20-150 | H | 79 | 20-150 |
| D5-NEtFOSA | | 82 | 20-150 | | 79 | 20-150 | H | 61 | 20-150 |
| D5-NEtFOSAA | | 94 | 20-150 | M-03 | 101 | 20-150 | H | 78 | 20-150 |
| D7-NMeFOSE | | 87 | 20-150 | | 77 | 20-150 | H | 73 | 20-150 |
| D9-NEtFOSE | | 81 | 20-150 | | 71 | 20-150 | H | 72 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-010
Description: VRTB-S-M5_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1005 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1820 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1907 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1226 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 46 | UH | 80 | 46 | 17 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 44 | UH | 80 | 44 | 13 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 46 | UH | 80 | 46 | 13 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 39 | HJM-03 | 80 | 30 | 12 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 30 | UH | 80 | 30 | 8.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 89 | HJM-03 | 100 | 92 | 40 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 200 | UH | 500 | 200 | 86 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 48 | UH | 80 | 48 | 20 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.6 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 16 | UH | 20 | 16 | 5.8 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 40 | UH | 200 | 40 | 12 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 16 | UH | 20 | 16 | 4.3 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 16 | UH | 20 | 16 | 5.9 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 40 | UH | 200 | 40 | 13 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 26 | UH | 40 | 26 | 12 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 22 | UH | 40 | 22 | 7.2 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 13 | UH | 40 | 13 | 3.7 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 26 | UH | 40 | 26 | 7.8 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 4.9 | HJM-03 | 20 | 7.0 | 1.9 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 24 | HJM-03 | 80 | 32 | 10 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 7.8 | UH | 20 | 7.8 | 3.3 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.7 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 7.8 | UH | 20 | 7.8 | 3.1 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 8.0 | UH | 20 | 8.0 | 2.1 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 35 | HM-03 | 20 | 7.6 | 3.8 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 77 | HM-03 | 20 | 16 | 4.3 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 200 | UH | 500 | 200 | 84 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 710 | HM-03 | 20 | 15 | 3.7 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 77 | HM-03 | 20 | 8.0 | 2.8 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 7.6 | UH | 20 | 7.6 | 2.9 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 22 | HM-03 | 20 | 8.0 | 2.1 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 8.0 | UHM-03 | 20 | 8.0 | 4.0 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 4800 | HM-03 | 20 | 15 | 4.9 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 130 | HM-03 | 20 | 16 | 4.2 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 14 | HJM-03 | 20 | 15 | 5.1 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 53 | H | 40 | 8.0 | 3.7 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 40 | UH | 100 | 40 | 12 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 16 | UH | 20 | 16 | 5.4 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 8.0 | UH | 20 | 8.0 | 3.9 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 16 | UH | 20 | 16 | 5.0 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-010
Description: VRTB-S-M5_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1005
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 97 | 20-150 | M-03 | 76 | 20-150 | H | 89 | 20-150 |
| 13C2-6:2FTS | | 99 | 20-150 | | 72 | 20-150 | H | 92 | 20-150 |
| 13C2-8:2FTS | | 73 | 20-150 | | 71 | 20-150 | H | 80 | 20-150 |
| 13C2-PFDoA | | 68 | 20-150 | M-03 | 62 | 20-150 | H | 76 | 20-150 |
| 13C2-PFTeDA | | 58 | 20-150 | | 60 | 20-150 | H | 74 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 84 | 20-150 | H | 88 | 20-150 |
| 13C3-PFBS | | 93 | 20-150 | M-03 | 78 | 20-150 | H | 94 | 20-150 |
| 13C3-PFHxS | | 87 | 20-150 | | 80 | 20-150 | H | 87 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 | | 85 | 20-150 | H | 89 | 20-150 |
| 13C4-PFHpA | | 81 | 20-150 | M-03 | 86 | 20-150 | H | 85 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | M-03 | 89 | 20-150 | H | 88 | 20-150 |
| 13C5-PFPeA | | 88 | 20-150 | | 85 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 80 | 20-150 | | 90 | 20-150 | H | 82 | 20-150 |
| 13C7-PFUnA | M-03 | 77 | 20-150 | M-03 | 73 | 20-150 | H | 81 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 | | 77 | 20-150 | H | 88 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | M-03 | 88 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOSA | | 103 | 20-150 | | 85 | 20-150 | H | 78 | 20-150 |
| 13C9-PFNA | | 92 | 20-150 | | 85 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 85 | 20-150 | | 76 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 111 | 20-150 | | 92 | 20-150 | H | 79 | 20-150 |
| D5-NEtFOSA | | 82 | 20-150 | | 79 | 20-150 | H | 61 | 20-150 |
| D5-NEtFOSAA | | 94 | 20-150 | M-03 | 101 | 20-150 | H | 78 | 20-150 |
| D7-NMeFOSE | | 87 | 20-150 | | 77 | 20-150 | H | 73 | 20-150 |
| D9-NEtFOSE | | 81 | 20-150 | | 71 | 20-150 | H | 72 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-011

Description: VRTB-S-06_04022024 | Matrix: Aqueous

Date Sampled: 04/02/2024 1110 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1848 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1916 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1236 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.82 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.63 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.1 | JM-03 | 3.8 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 6.1 | M-03 | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.94 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.4 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.4 | 1.9 | 0.59 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 14 | | 0.94 | 0.33 | 0.088 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 14 | | 3.8 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.59 | JM-03 | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 110 | M-03 | 0.94 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 23 | | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1200 | EM-03 | 0.94 | 0.69 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 49 | | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.69 | JM-03 | 0.94 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 8.6 | M-03 | 0.94 | 0.38 | 0.097 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 6.3 | M-03 | 0.94 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2200 | BELM-03 | 0.94 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 100 | M-03 | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 44 | M-03 | 0.94 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 25 | M-03 | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.56 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-011
Description: VRTB-S-06_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1110
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 88 | 20-150 | | 89 | 20-150 | H | 92 | 20-150 |
| 13C2-6:2FTS | | 82 | 20-150 | M-03 | 100 | 20-150 | H | 83 | 20-150 |
| 13C2-8:2FTS | | 83 | 20-150 | M-03 | 83 | 20-150 | H | 68 | 20-150 |
| 13C2-PFDoA | | 66 | 20-150 | | 73 | 20-150 | H | 66 | 20-150 |
| 13C2-PFTeDA | | 58 | 20-150 | | 60 | 20-150 | H | 59 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 81 | 20-150 | H | 89 | 20-150 |
| 13C3-PFBS | | 90 | 20-150 | | 84 | 20-150 | H | 85 | 20-150 |
| 13C3-PFHxS | | 81 | 20-150 | | 87 | 20-150 | H | 88 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | | 88 | 20-150 | H | 87 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 | M-03 | 81 | 20-150 | H | 87 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 84 | 20-150 | H | 87 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 | | 84 | 20-150 | H | 83 | 20-150 |
| 13C6-PFDA | | 86 | 20-150 | | 92 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 82 | 20-150 | | 77 | 20-150 | H | 63 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 | | 93 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 | | 87 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOSA | | 82 | 20-150 | | 81 | 20-150 | H | 67 | 20-150 |
| 13C9-PFNA | | 89 | 20-150 | | 91 | 20-150 | H | 70 | 20-150 |
| D3-NMeFOSA | | 70 | 20-150 | | 68 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | | 86 | 20-150 | | 78 | 20-150 | H | 59 | 20-150 |
| D5-NEtFOSA | | 65 | 20-150 | | 64 | 20-150 | H | 54 | 20-150 |
| D5-NEtFOSAA | | 74 | 20-150 | | 79 | 20-150 | H | 56 | 20-150 |
| D7-NMeFOSE | | 72 | 20-150 | | 72 | 20-150 | H | 59 | 20-150 |
| D9-NEtFOSE | | 66 | 20-150 | | 67 | 20-150 | H | 55 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-011

Description: VRTB-S-06_04022024 | Matrix: Aqueous

Date Sampled: 04/02/2024 1110 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1848 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1916 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1236 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.1 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.2 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.1 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.1 | U | 19 | 7.1 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 22 | UM-03 | 24 | 22 | 9.5 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.7 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.61 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.4 | U | 47 | 9.4 | 2.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.4 | U | 47 | 9.4 | 3.0 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.1 | U | 9.4 | 6.1 | 2.7 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.2 | U | 9.4 | 5.2 | 1.7 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.0 | U | 9.4 | 3.0 | 0.87 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.1 | U | 9.4 | 6.1 | 1.8 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 15 | M-03 | 4.7 | 1.6 | 0.44 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 14 | J | 19 | 7.6 | 2.4 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.78 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.64 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.73 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.50 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 94 | | 4.7 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 23 | | 4.7 | 3.8 | 1.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1100 | M-03 | 4.7 | 3.4 | 0.87 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 49 | | 4.7 | 1.9 | 0.67 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.69 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 9.6 | M-03 | 4.7 | 1.9 | 0.49 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 6.4 | M-03 | 4.7 | 1.9 | 0.94 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2200 | BLM-03 | 4.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 98 | | 4.7 | 3.8 | 0.99 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 38 | | 4.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 23 | M-03 | 9.4 | 1.9 | 0.87 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.6 | U | 24 | 9.6 | 2.8 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.91 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-011
Description: VRTB-S-06_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1110 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 88 | 20-150 | | 89 | 20-150 | H | 92 | 20-150 |
| 13C2-6:2FTS | | 82 | 20-150 | M-03 | 100 | 20-150 | H | 83 | 20-150 |
| 13C2-8:2FTS | | 83 | 20-150 | M-03 | 83 | 20-150 | H | 68 | 20-150 |
| 13C2-PFDoA | | 66 | 20-150 | | 73 | 20-150 | H | 66 | 20-150 |
| 13C2-PFTeDA | | 58 | 20-150 | | 60 | 20-150 | H | 59 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 81 | 20-150 | H | 89 | 20-150 |
| 13C3-PFBS | | 90 | 20-150 | | 84 | 20-150 | H | 85 | 20-150 |
| 13C3-PFHxS | | 81 | 20-150 | | 87 | 20-150 | H | 88 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | | 88 | 20-150 | H | 87 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 | M-03 | 81 | 20-150 | H | 87 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 84 | 20-150 | H | 87 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 | | 84 | 20-150 | H | 83 | 20-150 |
| 13C6-PFDA | | 86 | 20-150 | | 92 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 82 | 20-150 | | 77 | 20-150 | H | 63 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 | | 93 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 | | 87 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOSA | | 82 | 20-150 | | 81 | 20-150 | H | 67 | 20-150 |
| 13C9-PFNA | | 89 | 20-150 | | 91 | 20-150 | H | 70 | 20-150 |
| D3-NMeFOSA | | 70 | 20-150 | | 68 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | | 86 | 20-150 | | 78 | 20-150 | H | 59 | 20-150 |
| D5-NEtFOSA | | 65 | 20-150 | | 64 | 20-150 | H | 54 | 20-150 |
| D5-NEtFOSAA | | 74 | 20-150 | | 79 | 20-150 | H | 56 | 20-150 |
| D7-NMeFOSE | | 72 | 20-150 | | 72 | 20-150 | H | 59 | 20-150 |
| D9-NEtFOSE | | 66 | 20-150 | | 67 | 20-150 | H | 55 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-011
Description: VRTB-S-06_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1110 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1848 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1916 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1236 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 12 | UH | 20 | 12 | 4.4 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 11 | UH | 20 | 11 | 3.3 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 12 | UH | 20 | 12 | 3.3 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 7.5 | UH | 20 | 7.5 | 3.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.5 | UH | 20 | 7.5 | 2.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 23 | UH | 25 | 23 | 10 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 52 | UH | 130 | 52 | 21 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 12 | UH | 20 | 12 | 5.0 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.64 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.5 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 10 | UH | 50 | 10 | 3.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.5 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 10 | UH | 50 | 10 | 3.2 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.5 | UH | 10 | 6.5 | 2.9 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.5 | UH | 10 | 5.5 | 1.8 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.2 | UH | 10 | 3.2 | 0.92 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.5 | UH | 10 | 6.5 | 1.9 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 12 | HM-03 | 5.0 | 1.8 | 0.47 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 13 | HJM-03 | 20 | 8.0 | 2.6 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.82 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.68 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.77 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.53 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 90 | HM-03 | 5.0 | 1.9 | 0.95 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 20 | HM-03 | 5.0 | 4.0 | 1.1 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 52 | UH | 130 | 52 | 21 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1000 | HM-03 | 5.0 | 3.7 | 0.92 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 47 | H | 5.0 | 2.0 | 0.71 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.9 | UH | 5.0 | 1.9 | 0.73 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 8.6 | HM-03 | 5.0 | 2.0 | 0.52 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 5.3 | HM-03 | 5.0 | 2.0 | 0.99 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1800 | HM-03 | 5.0 | 3.7 | 1.2 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 110 | HM-03 | 5.0 | 4.0 | 1.0 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 36 | HM-03 | 5.0 | 3.8 | 1.3 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 22 | HM-03 | 10 | 2.0 | 0.92 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 10 | UH | 25 | 10 | 3.0 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.3 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 2.0 | UH | 5.0 | 2.0 | 0.97 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 4.0 | UH | 5.0 | 4.0 | 1.2 | ng/L | 3 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-011
Description: VRTB-S-06_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1110
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 88 | 20-150 | | 89 | 20-150 | H | 92 | 20-150 |
| 13C2-6:2FTS | | 82 | 20-150 | M-03 | 100 | 20-150 | H | 83 | 20-150 |
| 13C2-8:2FTS | | 83 | 20-150 | M-03 | 83 | 20-150 | H | 68 | 20-150 |
| 13C2-PFDoA | | 66 | 20-150 | | 73 | 20-150 | H | 66 | 20-150 |
| 13C2-PFTeDA | | 58 | 20-150 | | 60 | 20-150 | H | 59 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 81 | 20-150 | H | 89 | 20-150 |
| 13C3-PFBS | | 90 | 20-150 | | 84 | 20-150 | H | 85 | 20-150 |
| 13C3-PFHxS | | 81 | 20-150 | | 87 | 20-150 | H | 88 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | | 88 | 20-150 | H | 87 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 | M-03 | 81 | 20-150 | H | 87 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 84 | 20-150 | H | 87 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 | | 84 | 20-150 | H | 83 | 20-150 |
| 13C6-PFDA | | 86 | 20-150 | | 92 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 82 | 20-150 | | 77 | 20-150 | H | 63 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 | | 93 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 | | 87 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOSA | | 82 | 20-150 | | 81 | 20-150 | H | 67 | 20-150 |
| 13C9-PFNA | | 89 | 20-150 | | 91 | 20-150 | H | 70 | 20-150 |
| D3-NMeFOSA | | 70 | 20-150 | | 68 | 20-150 | H | 58 | 20-150 |
| D3-NMeFOSAA | | 86 | 20-150 | | 78 | 20-150 | H | 59 | 20-150 |
| D5-NEtFOSA | | 65 | 20-150 | | 64 | 20-150 | H | 54 | 20-150 |
| D5-NEtFOSAA | | 74 | 20-150 | | 79 | 20-150 | H | 56 | 20-150 |
| D7-NMeFOSE | | 72 | 20-150 | | 72 | 20-150 | H | 59 | 20-150 |
| D9-NEtFOSE | | 66 | 20-150 | | 67 | 20-150 | H | 55 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-012
Description: VRTB-S-R7_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1215 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1857 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 10 | 04/29/2024 1925 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1245 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.84 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 59 | | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 140 | | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.95 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.59 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.21 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.6 | 1.9 | 0.61 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.35 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 25 | | 0.96 | 0.34 | 0.090 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 54 | | 3.8 | 1.5 | 0.49 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.32 | JM-03 | 0.96 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.96 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 270 | | 0.96 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 150 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2500 | E | 0.96 | 0.70 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 230 | | 0.96 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.4 | M-03 | 0.96 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 96 | M-03 | 0.96 | 0.38 | 0.099 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 4.7 | M-03 | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 28000 | BELM-03 | 0.96 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 300 | | 0.96 | 0.77 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 71 | | 0.96 | 0.72 | 0.25 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 130 | | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.96 | 0.38 | 0.19 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.77 | U | 0.96 | 0.77 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-012
Description: VRTB-S-R7_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1215
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 20-150 | M-03 | 92 | 20-150 | H | 90 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 | M-03 | 82 | 20-150 | H | 93 | 20-150 |
| 13C2-8:2FTS | | 96 | 20-150 | M-03 | 96 | 20-150 | H | 88 | 20-150 |
| 13C2-PFDoA | | 76 | 20-150 | | 77 | 20-150 | H | 73 | 20-150 |
| 13C2-PFTeDA | | 61 | 20-150 | M-03 | 58 | 20-150 | H | 64 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 | | 77 | 20-150 | H | 88 | 20-150 |
| 13C3-PFBS | | 105 | 20-150 | | 87 | 20-150 | H | 93 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 | M-03 | 98 | 20-150 | H | 90 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 | | 93 | 20-150 | H | 88 | 20-150 |
| 13C4-PFHpA | | 88 | 20-150 | M-03 | 79 | 20-150 | H | 86 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 88 | 20-150 | H | 90 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 90 | 20-150 | H | 87 | 20-150 |
| 13C6-PFDA | | 88 | 20-150 | | 89 | 20-150 | H | 81 | 20-150 |
| 13C7-PFUnA | | 81 | 20-150 | M-03 | 73 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOA | | 72 | 20-150 | M-03 | 81 | 20-150 | H | 95 | 20-150 |
| 13C8-PFOS | | 91 | 20-150 | M-03 | 78 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOSA | | 136 | 20-150 | | 82 | 20-150 | H | 77 | 20-150 |
| 13C9-PFNA | | 83 | 20-150 | M-03 | 96 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 114 | 20-150 | M-03 | 76 | 20-150 | H | 48 | 20-150 |
| D3-NMeFOSAA | | 143 | 20-150 | | 87 | 20-150 | H | 80 | 20-150 |
| D5-NEtFOSA | | 112 | 20-150 | M-03 | 74 | 20-150 | H | 51 | 20-150 |
| D5-NEtFOSAA | M-03 | 118 | 20-150 | M-03 | 83 | 20-150 | H | 70 | 20-150 |
| D7-NMeFOSE | | 106 | 20-150 | | 69 | 20-150 | H | 69 | 20-150 |
| D9-NEtFOSE | | 90 | 20-150 | | 59 | 20-150 | H | 67 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-012
Description: VRTB-S-R7_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1215 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1857 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 10 | 04/29/2024 1925 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1245 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 22 | U | 38 | 22 | 8.4 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 21 | U | 38 | 21 | 6.4 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 22 | U | 38 | 22 | 6.4 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 50 | M-03 | 38 | 14 | 5.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 14 | U | 38 | 14 | 3.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 150 | M-03 | 48 | 44 | 19 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 96 | U | 240 | 96 | 41 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 23 | U | 38 | 23 | 9.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.8 | U | 9.6 | 3.8 | 1.2 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.7 | U | 9.6 | 7.7 | 2.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 19 | U | 96 | 19 | 5.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.7 | U | 9.6 | 7.7 | 2.1 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.7 | U | 9.6 | 7.7 | 2.8 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 19 | U | 96 | 19 | 6.1 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 12 | U | 19 | 12 | 5.5 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 10 | U | 19 | 10 | 3.5 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 6.1 | U | 19 | 6.1 | 1.8 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 12 | U | 19 | 12 | 3.7 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 25 | M-03 | 9.6 | 3.4 | 0.90 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 49 | M-03 | 38 | 15 | 4.9 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.7 | U | 9.6 | 3.7 | 1.6 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.8 | U | 9.6 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.7 | U | 9.6 | 3.7 | 1.5 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.8 | U | 9.6 | 3.8 | 1.0 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 190 | | 9.6 | 3.6 | 1.8 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 160 | | 9.6 | 7.7 | 2.0 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 96 | U | 240 | 96 | 40 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2100 | | 9.6 | 7.0 | 1.8 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 220 | | 9.6 | 3.8 | 1.4 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.6 | U | 9.6 | 3.6 | 1.4 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 97 | M-03 | 9.6 | 3.8 | 0.99 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 5.1 | JM-03 | 9.6 | 3.8 | 1.9 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 27000 | BELM-03 | 9.6 | 7.1 | 2.4 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 320 | M-03 | 9.6 | 7.7 | 2.0 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 54 | | 9.6 | 7.2 | 2.5 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 130 | M-03 | 19 | 3.8 | 1.8 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 19 | U | 48 | 19 | 5.7 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.7 | U | 9.6 | 7.7 | 2.6 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.8 | U | 9.6 | 3.8 | 1.9 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.7 | U | 9.6 | 7.7 | 2.4 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-012
Description: VRTB-S-R7_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1215
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 20-150 | M-03 | 92 | 20-150 | H | 90 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 | M-03 | 82 | 20-150 | H | 93 | 20-150 |
| 13C2-8:2FTS | | 96 | 20-150 | M-03 | 96 | 20-150 | H | 88 | 20-150 |
| 13C2-PFDoA | | 76 | 20-150 | | 77 | 20-150 | H | 73 | 20-150 |
| 13C2-PFTeDA | | 61 | 20-150 | M-03 | 58 | 20-150 | H | 64 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 | | 77 | 20-150 | H | 88 | 20-150 |
| 13C3-PFBS | | 105 | 20-150 | | 87 | 20-150 | H | 93 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 | M-03 | 98 | 20-150 | H | 90 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 | | 93 | 20-150 | H | 88 | 20-150 |
| 13C4-PFHpA | | 88 | 20-150 | M-03 | 79 | 20-150 | H | 86 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 88 | 20-150 | H | 90 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 90 | 20-150 | H | 87 | 20-150 |
| 13C6-PFDA | | 88 | 20-150 | | 89 | 20-150 | H | 81 | 20-150 |
| 13C7-PFUnA | | 81 | 20-150 | M-03 | 73 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOA | | 72 | 20-150 | M-03 | 81 | 20-150 | H | 95 | 20-150 |
| 13C8-PFOS | | 91 | 20-150 | M-03 | 78 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOSA | | 136 | 20-150 | | 82 | 20-150 | H | 77 | 20-150 |
| 13C9-PFNA | | 83 | 20-150 | M-03 | 96 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 114 | 20-150 | M-03 | 76 | 20-150 | H | 48 | 20-150 |
| D3-NMeFOSAA | | 143 | 20-150 | | 87 | 20-150 | H | 80 | 20-150 |
| D5-NEtFOSA | | 112 | 20-150 | M-03 | 74 | 20-150 | H | 51 | 20-150 |
| D5-NEtFOSAA | M-03 | 118 | 20-150 | M-03 | 83 | 20-150 | H | 70 | 20-150 |
| D7-NMeFOSE | | 106 | 20-150 | | 69 | 20-150 | H | 69 | 20-150 |
| D9-NEtFOSE | | 90 | 20-150 | | 59 | 20-150 | H | 67 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-012
Description: VRTB-S-R7_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1215 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1857 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 10 | 04/29/2024 1925 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1245 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | UH | 400 | 230 | 87 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | UH | 400 | 220 | 67 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | UH | 400 | 230 | 66 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 64 | HJM-03 | 400 | 150 | 61 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | UH | 400 | 150 | 40 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 460 | UH | 500 | 460 | 200 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | UH | 2500 | 1000 | 430 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | UH | 400 | 240 | 99 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | UH | 100 | 40 | 13 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | UH | 1000 | 200 | 61 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | UH | 100 | 80 | 22 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | UH | 1000 | 200 | 63 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | UH | 200 | 130 | 58 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | UH | 200 | 110 | 36 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | UH | 200 | 64 | 18 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | UH | 200 | 130 | 39 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 25 | HJM-03 | 100 | 35 | 9.4 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 56 | HJM-03 | 400 | 160 | 51 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | UH | 100 | 39 | 16 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | UH | 100 | 40 | 14 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | UH | 100 | 39 | 15 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | UH | 100 | 40 | 11 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 150 | HM-03 | 100 | 38 | 19 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 150 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | UH | 2500 | 1000 | 420 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2400 | HM-03 | 100 | 73 | 18 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 210 | HM-03 | 100 | 40 | 14 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | UH | 100 | 38 | 15 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 83 | HJM-03 | 100 | 40 | 10 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 40 | UHM-03 | 100 | 40 | 20 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 23000 | HM-03 | 100 | 74 | 25 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 270 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 42 | HJM-03 | 100 | 75 | 26 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 130 | HJM-03 | 200 | 40 | 18 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | UH | 500 | 200 | 60 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | UH | 100 | 80 | 27 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | UH | 100 | 40 | 19 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | UH | 100 | 80 | 25 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-012
Description: VRTB-S-R7_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1215
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 20-150 | M-03 | 92 | 20-150 | H | 90 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 | M-03 | 82 | 20-150 | H | 93 | 20-150 |
| 13C2-8:2FTS | | 96 | 20-150 | M-03 | 96 | 20-150 | H | 88 | 20-150 |
| 13C2-PFDoA | | 76 | 20-150 | | 77 | 20-150 | H | 73 | 20-150 |
| 13C2-PFTeDA | | 61 | 20-150 | M-03 | 58 | 20-150 | H | 64 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 | | 77 | 20-150 | H | 88 | 20-150 |
| 13C3-PFBS | | 105 | 20-150 | | 87 | 20-150 | H | 93 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 | M-03 | 98 | 20-150 | H | 90 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 | | 93 | 20-150 | H | 88 | 20-150 |
| 13C4-PFHpA | | 88 | 20-150 | M-03 | 79 | 20-150 | H | 86 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 88 | 20-150 | H | 90 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 90 | 20-150 | H | 87 | 20-150 |
| 13C6-PFDA | | 88 | 20-150 | | 89 | 20-150 | H | 81 | 20-150 |
| 13C7-PFUnA | | 81 | 20-150 | M-03 | 73 | 20-150 | H | 71 | 20-150 |
| 13C8-PFOA | | 72 | 20-150 | M-03 | 81 | 20-150 | H | 95 | 20-150 |
| 13C8-PFOS | | 91 | 20-150 | M-03 | 78 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOSA | | 136 | 20-150 | | 82 | 20-150 | H | 77 | 20-150 |
| 13C9-PFNA | | 83 | 20-150 | M-03 | 96 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 114 | 20-150 | M-03 | 76 | 20-150 | H | 48 | 20-150 |
| D3-NMeFOSAA | | 143 | 20-150 | | 87 | 20-150 | H | 80 | 20-150 |
| D5-NEtFOSA | | 112 | 20-150 | M-03 | 74 | 20-150 | H | 51 | 20-150 |
| D5-NEtFOSAA | M-03 | 118 | 20-150 | M-03 | 83 | 20-150 | H | 70 | 20-150 |
| D7-NMeFOSE | | 106 | 20-150 | | 69 | 20-150 | H | 69 | 20-150 |
| D9-NEtFOSE | | 90 | 20-150 | | 59 | 20-150 | H | 67 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-013

Description: VRTB-S-P8_04022024 | Matrix: Aqueous

Date Sampled: 04/02/2024 1330 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1916 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1935 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1254 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.82 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.63 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 9.7 | | 3.7 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 24 | | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.93 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.4 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.4 | 1.9 | 0.59 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 47 | | 0.94 | 0.33 | 0.088 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 24 | M-03 | 3.7 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 140 | | 0.94 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 40 | | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1200 | E | 0.94 | 0.69 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 78 | | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.94 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 36 | M-03 | 0.94 | 0.38 | 0.096 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.6 | M-03 | 0.94 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 13000 | BELM-03 | 0.94 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 96 | | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 42 | M-03 | 0.94 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 46 | M-03 | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.56 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-013

Description: VRTB-S-P8_04022024 | Matrix: Aqueous

Date Sampled: 04/02/2024 1330 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 20-150 | | 88 | 20-150 | H | 91 | 20-150 |
| 13C2-6:2FTS | | 94 | 20-150 | M-03 | 86 | 20-150 | H | 101 | 20-150 |
| 13C2-8:2FTS | | 83 | 20-150 | M-03 | 79 | 20-150 | HM-03 | 92 | 20-150 |
| 13C2-PFDoA | | 75 | 20-150 | | 71 | 20-150 | H | 78 | 20-150 |
| 13C2-PFTeDA | | 58 | 20-150 | | 55 | 20-150 | H | 78 | 20-150 |
| 13C3-HFPO-DA | | 84 | 20-150 | | 87 | 20-150 | H | 95 | 20-150 |
| 13C3-PFBS | | 100 | 20-150 | | 87 | 20-150 | H | 92 | 20-150 |
| 13C3-PFHxS | | 92 | 20-150 | | 76 | 20-150 | H | 91 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | | 87 | 20-150 | H | 91 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 | | 89 | 20-150 | H | 89 | 20-150 |
| 13C5-PFHxA | | 91 | 20-150 | | 91 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 | | 96 | 20-150 | H | 90 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | M-03 | 81 | 20-150 | H | 86 | 20-150 |
| 13C7-PFUnA | | 83 | 20-150 | M-03 | 90 | 20-150 | H | 87 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 | | 85 | 20-150 | H | 89 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | | 87 | 20-150 | H | 86 | 20-150 |
| 13C8-PFOSA | | 113 | 20-150 | | 94 | 20-150 | H | 94 | 20-150 |
| 13C9-PFNA | | 87 | 20-150 | | 95 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 103 | 20-150 | | 84 | 20-150 | H | 73 | 20-150 |
| D3-NMeFOSAA | | 106 | 20-150 | M-03 | 87 | 20-150 | H | 89 | 20-150 |
| D5-NEtFOSA | | 98 | 20-150 | | 88 | 20-150 | H | 63 | 20-150 |
| D5-NEtFOSAA | | 95 | 20-150 | M-03 | 92 | 20-150 | H | 82 | 20-150 |
| D7-NMeFOSE | | 105 | 20-150 | | 89 | 20-150 | H | 77 | 20-150 |
| D9-NEtFOSE | | 100 | 20-150 | | 85 | 20-150 | H | 76 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-013

Description: VRTB-S-P8_04022024 | Matrix: Aqueous

Date Sampled: 04/02/2024 1330 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1916 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1935 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1254 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.1 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.1 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.1 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 8.9 | J | 19 | 7.1 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 26 | M-03 | 23 | 21 | 9.5 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.6 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.60 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.4 | U | 47 | 9.4 | 2.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.4 | U | 47 | 9.4 | 3.0 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.1 | U | 9.4 | 6.1 | 2.7 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.2 | U | 9.4 | 5.2 | 1.7 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.0 | U | 9.4 | 3.0 | 0.87 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.1 | U | 9.4 | 6.1 | 1.8 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 43 | | 4.7 | 1.6 | 0.44 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 23 | | 19 | 7.6 | 2.4 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.77 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.63 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.72 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.50 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 110 | | 4.7 | 1.8 | 0.89 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 36 | | 4.7 | 3.8 | 0.99 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1300 | | 4.7 | 3.4 | 0.86 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 77 | | 4.7 | 1.9 | 0.66 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.8 | U | 4.7 | 1.8 | 0.68 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 32 | M-03 | 4.7 | 1.9 | 0.48 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.8 | JM-03 | 4.7 | 1.9 | 0.93 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 11000 | BELM-03 | 4.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 100 | M-03 | 4.7 | 3.8 | 0.98 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 39 | | 4.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 44 | M-03 | 9.4 | 1.9 | 0.86 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.2 | U | 23 | 9.2 | 2.8 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.91 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.8 | U | 4.7 | 3.8 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-013
Description: VRTB-S-P8_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1330 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 20-150 | | 88 | 20-150 | H | 91 | 20-150 |
| 13C2-6:2FTS | | 94 | 20-150 | M-03 | 86 | 20-150 | H | 101 | 20-150 |
| 13C2-8:2FTS | | 83 | 20-150 | M-03 | 79 | 20-150 | HM-03 | 92 | 20-150 |
| 13C2-PFDoA | | 75 | 20-150 | | 71 | 20-150 | H | 78 | 20-150 |
| 13C2-PFTeDA | | 58 | 20-150 | | 55 | 20-150 | H | 78 | 20-150 |
| 13C3-HFPO-DA | | 84 | 20-150 | | 87 | 20-150 | H | 95 | 20-150 |
| 13C3-PFBS | | 100 | 20-150 | | 87 | 20-150 | H | 92 | 20-150 |
| 13C3-PFHxS | | 92 | 20-150 | | 76 | 20-150 | H | 91 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | | 87 | 20-150 | H | 91 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 | | 89 | 20-150 | H | 89 | 20-150 |
| 13C5-PFHxA | | 91 | 20-150 | | 91 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 | | 96 | 20-150 | H | 90 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | M-03 | 81 | 20-150 | H | 86 | 20-150 |
| 13C7-PFUnA | | 83 | 20-150 | M-03 | 90 | 20-150 | H | 87 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 | | 85 | 20-150 | H | 89 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | | 87 | 20-150 | H | 86 | 20-150 |
| 13C8-PFOSA | | 113 | 20-150 | | 94 | 20-150 | H | 94 | 20-150 |
| 13C9-PFNA | | 87 | 20-150 | | 95 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 103 | 20-150 | | 84 | 20-150 | H | 73 | 20-150 |
| D3-NMeFOSAA | | 106 | 20-150 | M-03 | 87 | 20-150 | H | 89 | 20-150 |
| D5-NEtFOSA | | 98 | 20-150 | | 88 | 20-150 | H | 63 | 20-150 |
| D5-NEtFOSAA | | 95 | 20-150 | M-03 | 92 | 20-150 | H | 82 | 20-150 |
| D7-NMeFOSE | | 105 | 20-150 | | 89 | 20-150 | H | 77 | 20-150 |
| D9-NEtFOSE | | 100 | 20-150 | | 85 | 20-150 | H | 76 | 20-150 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-013
Description: VRTB-S-P8_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1330 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1916 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1935 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1254 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 75 | UH | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 230 | UH | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 45 | HJM-03 | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 80 | UHM-03 | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 94 | HM-03 | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 39 | HJ | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 960 | H | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 73 | HM-03 | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 36 | HJM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UHM-03 | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 9600 | HM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 110 | H | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 19 | HJM-03 | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 41 | HJM-03 | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-013
Description: VRTB-S-P8_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1330
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 20-150 | | 88 | 20-150 | H | 91 | 20-150 |
| 13C2-6:2FTS | | 94 | 20-150 | M-03 | 86 | 20-150 | H | 101 | 20-150 |
| 13C2-8:2FTS | | 83 | 20-150 | M-03 | 79 | 20-150 | HM-03 | 92 | 20-150 |
| 13C2-PFDoA | | 75 | 20-150 | | 71 | 20-150 | H | 78 | 20-150 |
| 13C2-PFTeDA | | 58 | 20-150 | | 55 | 20-150 | H | 78 | 20-150 |
| 13C3-HFPO-DA | | 84 | 20-150 | | 87 | 20-150 | H | 95 | 20-150 |
| 13C3-PFBS | | 100 | 20-150 | | 87 | 20-150 | H | 92 | 20-150 |
| 13C3-PFHxS | | 92 | 20-150 | | 76 | 20-150 | H | 91 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | | 87 | 20-150 | H | 91 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 | | 89 | 20-150 | H | 89 | 20-150 |
| 13C5-PFHxA | | 91 | 20-150 | | 91 | 20-150 | H | 91 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 | | 96 | 20-150 | H | 90 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | M-03 | 81 | 20-150 | H | 86 | 20-150 |
| 13C7-PFUnA | | 83 | 20-150 | M-03 | 90 | 20-150 | H | 87 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 | | 85 | 20-150 | H | 89 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | | 87 | 20-150 | H | 86 | 20-150 |
| 13C8-PFOSA | | 113 | 20-150 | | 94 | 20-150 | H | 94 | 20-150 |
| 13C9-PFNA | | 87 | 20-150 | | 95 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 103 | 20-150 | | 84 | 20-150 | H | 73 | 20-150 |
| D3-NMeFOSAA | | 106 | 20-150 | M-03 | 87 | 20-150 | H | 89 | 20-150 |
| D5-NEtFOSA | | 98 | 20-150 | | 88 | 20-150 | H | 63 | 20-150 |
| D5-NEtFOSAA | | 95 | 20-150 | M-03 | 92 | 20-150 | H | 82 | 20-150 |
| D7-NMeFOSE | | 105 | 20-150 | | 89 | 20-150 | H | 77 | 20-150 |
| D9-NEtFOSE | | 100 | 20-150 | | 85 | 20-150 | H | 76 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-014
Description: VRTB-D-B1_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1520 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1925 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1944 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1303 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.81 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.62 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 3.4 | JM-03 | 3.7 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 24 | M-03 | 4.6 | 4.2 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.92 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.59 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 13 | | 0.93 | 0.33 | 0.087 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 20 | M-03 | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.099 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 41 | | 0.93 | 0.35 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 56 | M-03 | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 910 | EM-03 | 0.93 | 0.68 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 49 | | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.93 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 20 | M-03 | 0.93 | 0.37 | 0.096 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2700 | BELM-03 | 0.93 | 0.69 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 110 | M-03 | 0.93 | 0.74 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 29 | | 0.93 | 0.70 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 39 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-014
Description: VRTB-D-B1_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1520
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | | 91 | 20-150 | H | 94 | 20-150 |
| 13C2-6:2FTS | | 97 | 20-150 | | 110 | 20-150 | HM-03 | 89 | 20-150 |
| 13C2-8:2FTS | | 102 | 20-150 | M-03 | 94 | 20-150 | H | 84 | 20-150 |
| 13C2-PFDoA | | 73 | 20-150 | | 72 | 20-150 | H | 53 | 20-150 |
| 13C2-PFTeDA | M-03 | 43 | 20-150 | | 39 | 20-150 | H | 50 | 20-150 |
| 13C3-HFPO-DA | | 94 | 20-150 | | 87 | 20-150 | H | 96 | 20-150 |
| 13C3-PFBS | | 94 | 20-150 | | 104 | 20-150 | H | 96 | 20-150 |
| 13C3-PFHxS | | 94 | 20-150 | | 98 | 20-150 | H | 93 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | | 93 | 20-150 | H | 94 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 | | 93 | 20-150 | H | 92 | 20-150 |
| 13C5-PFHxA | | 95 | 20-150 | | 89 | 20-150 | H | 95 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 92 | 20-150 | H | 87 | 20-150 |
| 13C6-PFDA | | 93 | 20-150 | M-03 | 81 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 87 | 20-150 | | 85 | 20-150 | H | 62 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 | | 94 | 20-150 | H | 94 | 20-150 |
| 13C8-PFOS | | 90 | 20-150 | M-03 | 85 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOSA | | 88 | 20-150 | | 83 | 20-150 | H | 63 | 20-150 |
| 13C9-PFNA | | 88 | 20-150 | | 88 | 20-150 | H | 81 | 20-150 |
| D3-NMeFOSA | | 71 | 20-150 | | 59 | 20-150 | H | 55 | 20-150 |
| D3-NMeFOSAA | M-03 | 111 | 20-150 | M-03 | 93 | 20-150 | H | 58 | 20-150 |
| D5-NEtFOSA | | 61 | 20-150 | | 56 | 20-150 | H | 53 | 20-150 |
| D5-NEtFOSAA | M-03 | 95 | 20-150 | | 83 | 20-150 | H | 56 | 20-150 |
| D7-NMeFOSE | | 77 | 20-150 | | 71 | 20-150 | H | 57 | 20-150 |
| D9-NEtFOSE | | 65 | 20-150 | | 60 | 20-150 | H | 51 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-014
Description: VRTB-D-B1_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1520
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1925 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1944 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1303 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 11 | U | 19 | 11 | 4.1 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 10 | U | 19 | 10 | 3.1 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 11 | U | 19 | 11 | 3.1 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 3.0 | JM-03 | 19 | 7.1 | 2.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 7.1 | U | 19 | 7.1 | 1.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 21 | JM-03 | 23 | 21 | 9.4 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 48 | U | 120 | 48 | 20 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 19 | 11 | 4.6 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.60 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.7 | U | 4.6 | 3.7 | 1.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 9.2 | U | 46 | 9.2 | 2.8 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.7 | U | 4.6 | 3.7 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.7 | U | 4.6 | 3.7 | 1.4 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 9.2 | U | 46 | 9.2 | 2.9 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 6.0 | U | 9.3 | 6.0 | 2.7 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 5.1 | U | 9.3 | 5.1 | 1.7 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 3.0 | U | 9.3 | 3.0 | 0.86 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 6.0 | U | 9.3 | 6.0 | 1.8 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 11 | M-03 | 4.6 | 1.6 | 0.44 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 16 | J | 19 | 7.6 | 2.4 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.76 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.63 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.72 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.50 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 38 | | 4.6 | 1.7 | 0.88 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 42 | | 4.6 | 3.7 | 0.99 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 48 | U | 120 | 48 | 19 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 830 | | 4.6 | 3.4 | 0.86 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 48 | | 4.6 | 1.8 | 0.66 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.7 | U | 4.6 | 1.7 | 0.68 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 17 | M-03 | 4.6 | 1.8 | 0.48 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.92 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2800 | BELM-03 | 4.6 | 3.4 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 110 | M-03 | 4.6 | 3.7 | 0.97 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 27 | | 4.6 | 3.5 | 1.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 38 | | 9.3 | 1.9 | 0.86 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 9.2 | U | 23 | 9.2 | 2.8 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.7 | U | 4.6 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.90 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.7 | U | 4.6 | 3.7 | 1.2 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-014
Description: VRTB-D-B1_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1520
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | | 91 | 20-150 | H | 94 | 20-150 |
| 13C2-6:2FTS | | 97 | 20-150 | | 110 | 20-150 | HM-03 | 89 | 20-150 |
| 13C2-8:2FTS | | 102 | 20-150 | M-03 | 94 | 20-150 | H | 84 | 20-150 |
| 13C2-PFDoA | | 73 | 20-150 | | 72 | 20-150 | H | 53 | 20-150 |
| 13C2-PFTeDA | M-03 | 43 | 20-150 | | 39 | 20-150 | H | 50 | 20-150 |
| 13C3-HFPO-DA | | 94 | 20-150 | | 87 | 20-150 | H | 96 | 20-150 |
| 13C3-PFBS | | 94 | 20-150 | | 104 | 20-150 | H | 96 | 20-150 |
| 13C3-PFHxS | | 94 | 20-150 | | 98 | 20-150 | H | 93 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | | 93 | 20-150 | H | 94 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 | | 93 | 20-150 | H | 92 | 20-150 |
| 13C5-PFHxA | | 95 | 20-150 | | 89 | 20-150 | H | 95 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 92 | 20-150 | H | 87 | 20-150 |
| 13C6-PFDA | | 93 | 20-150 | M-03 | 81 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 87 | 20-150 | | 85 | 20-150 | H | 62 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 | | 94 | 20-150 | H | 94 | 20-150 |
| 13C8-PFOS | | 90 | 20-150 | M-03 | 85 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOSA | | 88 | 20-150 | | 83 | 20-150 | H | 63 | 20-150 |
| 13C9-PFNA | | 88 | 20-150 | | 88 | 20-150 | H | 81 | 20-150 |
| D3-NMeFOSA | | 71 | 20-150 | | 59 | 20-150 | H | 55 | 20-150 |
| D3-NMeFOSAA | M-03 | 111 | 20-150 | M-03 | 93 | 20-150 | H | 58 | 20-150 |
| D5-NEtFOSA | | 61 | 20-150 | | 56 | 20-150 | H | 53 | 20-150 |
| D5-NEtFOSAA | M-03 | 95 | 20-150 | | 83 | 20-150 | H | 56 | 20-150 |
| D7-NMeFOSE | | 77 | 20-150 | | 71 | 20-150 | H | 57 | 20-150 |
| D9-NEtFOSE | | 65 | 20-150 | | 60 | 20-150 | H | 51 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-014
Description: VRTB-D-B1_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1520 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1925 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1944 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 1303 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 23 | UH | 40 | 23 | 8.7 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 22 | UH | 40 | 22 | 6.7 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 23 | UH | 40 | 23 | 6.6 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 15 | UH | 40 | 15 | 6.1 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 15 | UH | 40 | 15 | 4.0 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 46 | UHM-03 | 50 | 46 | 20 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 100 | UH | 250 | 100 | 43 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 24 | UH | 40 | 24 | 9.9 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 4.0 | UH | 10 | 4.0 | 1.3 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 8.0 | UH | 10 | 8.0 | 2.9 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 20 | UH | 100 | 20 | 6.1 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 8.0 | UH | 10 | 8.0 | 2.2 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 8.0 | UH | 10 | 8.0 | 2.9 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 20 | UH | 100 | 20 | 6.3 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 13 | UH | 20 | 13 | 5.8 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 11 | UH | 20 | 11 | 3.6 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 6.4 | UH | 20 | 6.4 | 1.8 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 13 | UH | 20 | 13 | 3.9 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.2 | HJM-03 | 10 | 3.5 | 0.94 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 16 | HJM-03 | 40 | 16 | 5.1 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.9 | UH | 10 | 3.9 | 1.6 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 4.0 | UH | 10 | 4.0 | 1.4 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.9 | UH | 10 | 3.9 | 1.5 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 4.0 | UH | 10 | 4.0 | 1.1 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 33 | HM-03 | 10 | 3.8 | 1.9 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 43 | HM-03 | 10 | 8.0 | 2.1 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 100 | UH | 250 | 100 | 42 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 750 | HM-03 | 10 | 7.3 | 1.8 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 40 | H | 10 | 4.0 | 1.4 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.8 | UH | 10 | 3.8 | 1.5 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 15 | HM-03 | 10 | 4.0 | 1.0 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 4.0 | UH | 10 | 4.0 | 2.0 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2300 | HM-03 | 10 | 7.4 | 2.5 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 92 | H | 10 | 8.0 | 2.1 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 28 | HM-03 | 10 | 7.5 | 2.6 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 34 | HM-03 | 20 | 4.0 | 1.8 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 20 | UH | 50 | 20 | 6.0 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 8.0 | UH | 10 | 8.0 | 2.7 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 4.0 | UH | 10 | 4.0 | 1.9 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 8.0 | UH | 10 | 8.0 | 2.5 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-014
Description: VRTB-D-B1_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1520
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 | | 91 | 20-150 | H | 94 | 20-150 |
| 13C2-6:2FTS | | 97 | 20-150 | | 110 | 20-150 | HM-03 | 89 | 20-150 |
| 13C2-8:2FTS | | 102 | 20-150 | M-03 | 94 | 20-150 | H | 84 | 20-150 |
| 13C2-PFDoA | | 73 | 20-150 | | 72 | 20-150 | H | 53 | 20-150 |
| 13C2-PFTeDA | M-03 | 43 | 20-150 | | 39 | 20-150 | H | 50 | 20-150 |
| 13C3-HFPO-DA | | 94 | 20-150 | | 87 | 20-150 | H | 96 | 20-150 |
| 13C3-PFBS | | 94 | 20-150 | | 104 | 20-150 | H | 96 | 20-150 |
| 13C3-PFHxS | | 94 | 20-150 | | 98 | 20-150 | H | 93 | 20-150 |
| 13C4-PFBA | | 93 | 20-150 | | 93 | 20-150 | H | 94 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 | | 93 | 20-150 | H | 92 | 20-150 |
| 13C5-PFHxA | | 95 | 20-150 | | 89 | 20-150 | H | 95 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 | | 92 | 20-150 | H | 87 | 20-150 |
| 13C6-PFDA | | 93 | 20-150 | M-03 | 81 | 20-150 | H | 77 | 20-150 |
| 13C7-PFUnA | | 87 | 20-150 | | 85 | 20-150 | H | 62 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 | | 94 | 20-150 | H | 94 | 20-150 |
| 13C8-PFOS | | 90 | 20-150 | M-03 | 85 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOSA | | 88 | 20-150 | | 83 | 20-150 | H | 63 | 20-150 |
| 13C9-PFNA | | 88 | 20-150 | | 88 | 20-150 | H | 81 | 20-150 |
| D3-NMeFOSA | | 71 | 20-150 | | 59 | 20-150 | H | 55 | 20-150 |
| D3-NMeFOSAA | M-03 | 111 | 20-150 | M-03 | 93 | 20-150 | H | 58 | 20-150 |
| D5-NEtFOSA | | 61 | 20-150 | | 56 | 20-150 | H | 53 | 20-150 |
| D5-NEtFOSAA | M-03 | 95 | 20-150 | | 83 | 20-150 | H | 56 | 20-150 |
| D7-NMeFOSE | | 77 | 20-150 | | 71 | 20-150 | H | 57 | 20-150 |
| D9-NEtFOSE | | 65 | 20-150 | | 60 | 20-150 | H | 51 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-015
Description: VRTB-D-S2_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1610 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1934 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1331 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.55 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.1 | U | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.55 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.57 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 18 | M-03 | 0.90 | 0.32 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 5.8 | M-03 | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.096 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 8.3 | M-03 | 0.90 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 7.1 | M-03 | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 170 | | 0.90 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 12 | M-03 | 0.90 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.90 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.73 | JM-03 | 0.90 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | UM-03 | 0.90 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 280 | BLM-03 | 0.90 | 0.67 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 16 | M-03 | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 37 | | 0.90 | 0.68 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 9.0 | M-03 | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-015
Description: VRTB-D-S2_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1610
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 81 | 20-150 | H | 97 | 20-150 |
| 13C2-6:2FTS | | 81 | 20-150 | H | 95 | 20-150 |
| 13C2-8:2FTS | | 76 | 20-150 | H | 88 | 20-150 |
| 13C2-PFDoA | | 80 | 20-150 | H | 68 | 20-150 |
| 13C2-PFTeDA | | 43 | 20-150 | H | 38 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 | H | 91 | 20-150 |
| 13C3-PFBS | | 76 | 20-150 | H | 98 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 | H | 92 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 | H | 94 | 20-150 |
| 13C4-PFHpA | | 80 | 20-150 | H | 90 | 20-150 |
| 13C5-PFHxA | | 85 | 20-150 | H | 89 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 82 | 20-150 | H | 86 | 20-150 |
| 13C7-PFUnA | | 82 | 20-150 | H | 79 | 20-150 |
| 13C8-PFOA | | 77 | 20-150 | H | 88 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | H | 90 | 20-150 |
| 13C8-PFOSA | | 77 | 20-150 | H | 81 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | H | 88 | 20-150 |
| D3-NMeFOSA | | 61 | 20-150 | H | 62 | 20-150 |
| D3-NMeFOSAA | | 87 | 20-150 | H | 67 | 20-150 |
| D5-NEtFOSA | | 58 | 20-150 | H | 55 | 20-150 |
| D5-NEtFOSAA | | 81 | 20-150 | H | 66 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 | H | 53 | 20-150 |
| D9-NEtFOSE | | 62 | 20-150 | H | 33 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-015
Description: VRTB-D-S2_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1610 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1934 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1331 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | UH | 3.5 | 2.0 | 0.76 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | UH | 3.5 | 1.9 | 0.58 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | UH | 3.5 | 2.0 | 0.58 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.3 | UH | 3.5 | 1.3 | 0.53 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | UH | 3.5 | 1.3 | 0.35 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | UH | 4.3 | 4.0 | 1.8 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | UH | 22 | 8.8 | 3.7 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | UH | 3.5 | 2.1 | 0.86 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | UH | 0.87 | 0.35 | 0.11 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | UH | 0.87 | 0.70 | 0.25 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.7 | UH | 8.7 | 1.7 | 0.53 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | UH | 0.87 | 0.70 | 0.19 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | UH | 0.87 | 0.70 | 0.26 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.7 | UH | 8.7 | 1.7 | 0.55 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.1 | UH | 1.7 | 1.1 | 0.50 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.94 | UH | 1.7 | 0.94 | 0.31 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.54 | UH | 1.7 | 0.54 | 0.16 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.1 | UH | 1.7 | 1.1 | 0.34 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 14 | H | 0.87 | 0.30 | 0.082 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 5.5 | H | 3.5 | 1.4 | 0.44 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | UH | 0.87 | 0.34 | 0.14 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.35 | UH | 0.87 | 0.35 | 0.12 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | UH | 0.87 | 0.34 | 0.13 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | UH | 0.87 | 0.35 | 0.093 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 7.5 | HM-03 | 0.87 | 0.33 | 0.17 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 6.7 | H | 0.87 | 0.70 | 0.18 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | UH | 22 | 8.8 | 3.6 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 180 | HM-03 | 0.87 | 0.64 | 0.16 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 10 | H | 0.87 | 0.35 | 0.12 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.33 | UH | 0.87 | 0.33 | 0.13 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.68 | HJM-03 | 0.87 | 0.35 | 0.090 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.35 | UHM-03 | 0.87 | 0.35 | 0.17 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 240 | HM-03 | 0.87 | 0.64 | 0.21 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 14 | HM-03 | 0.87 | 0.70 | 0.18 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 36 | HM-03 | 0.87 | 0.65 | 0.22 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 7.5 | HM-03 | 1.7 | 0.34 | 0.16 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.7 | UH | 4.3 | 1.7 | 0.52 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | UH | 0.87 | 0.70 | 0.23 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | UH | 0.87 | 0.35 | 0.17 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | UH | 0.87 | 0.70 | 0.22 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-015
Description: VRTB-D-S2_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1610
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 81 | 20-150 | H | 97 | 20-150 |
| 13C2-6:2FTS | | 81 | 20-150 | H | 95 | 20-150 |
| 13C2-8:2FTS | | 76 | 20-150 | H | 88 | 20-150 |
| 13C2-PFDoA | | 80 | 20-150 | H | 68 | 20-150 |
| 13C2-PFTeDA | | 43 | 20-150 | H | 38 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 | H | 91 | 20-150 |
| 13C3-PFBS | | 76 | 20-150 | H | 98 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 | H | 92 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 | H | 94 | 20-150 |
| 13C4-PFHpA | | 80 | 20-150 | H | 90 | 20-150 |
| 13C5-PFHxA | | 85 | 20-150 | H | 89 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 82 | 20-150 | H | 86 | 20-150 |
| 13C7-PFUnA | | 82 | 20-150 | H | 79 | 20-150 |
| 13C8-PFOA | | 77 | 20-150 | H | 88 | 20-150 |
| 13C8-PFOS | | 84 | 20-150 | H | 90 | 20-150 |
| 13C8-PFOSA | | 77 | 20-150 | H | 81 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 | H | 88 | 20-150 |
| D3-NMeFOSA | | 61 | 20-150 | H | 62 | 20-150 |
| D3-NMeFOSAA | | 87 | 20-150 | H | 67 | 20-150 |
| D5-NEtFOSA | | 58 | 20-150 | H | 55 | 20-150 |
| D5-NEtFOSAA | | 81 | 20-150 | H | 66 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 | H | 53 | 20-150 |
| D9-NEtFOSE | | 62 | 20-150 | H | 33 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-016
Description: VRTB-D-Y3_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1715 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1943 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1340 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.82 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.63 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.3 | U | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.93 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.59 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 2.8 | M-03 | 0.93 | 0.33 | 0.088 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 4.7 | M-03 | 3.7 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.9 | M-03 | 0.93 | 0.35 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 3.0 | M-03 | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 59 | | 0.93 | 0.68 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 5.0 | M-03 | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.93 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.096 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 110 | BLM-03 | 0.93 | 0.69 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 5.2 | M-03 | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 7.1 | | 0.93 | 0.70 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 3.9 | M-03 | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.56 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-016
Description: VRTB-D-Y3_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1715
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 | H | 91 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 | H | 90 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | HM-03 | 84 | 20-150 |
| 13C2-PFDoA | | 73 | 20-150 | H | 57 | 20-150 |
| 13C2-PFTeDA | | 43 | 20-150 | H | 35 | 20-150 |
| 13C3-HFPO-DA | | 84 | 20-150 | H | 89 | 20-150 |
| 13C3-PFBS | | 94 | 20-150 | H | 95 | 20-150 |
| 13C3-PFHxS | | 88 | 20-150 | H | 91 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 | H | 88 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 | H | 85 | 20-150 |
| 13C5-PFHxA | | 86 | 20-150 | H | 87 | 20-150 |
| 13C5-PFPeA | | 88 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 93 | 20-150 | H | 79 | 20-150 |
| 13C7-PFUnA | | 84 | 20-150 | H | 77 | 20-150 |
| 13C8-PFOA | | 84 | 20-150 | H | 91 | 20-150 |
| 13C8-PFOS | | 86 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOSA | | 72 | 20-150 | H | 78 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 | H | 81 | 20-150 |
| D3-NMeFOSA | M-03 | 65 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 82 | 20-150 | H | 64 | 20-150 |
| D5-NEtFOSA | | 59 | 20-150 | H | 53 | 20-150 |
| D5-NEtFOSAA | | 81 | 20-150 | H | 58 | 20-150 |
| D7-NMeFOSE | | 65 | 20-150 | H | 63 | 20-150 |
| D9-NEtFOSE | | 61 | 20-150 | H | 54 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-016

Description: VRTB-D-Y3_04022024 | Matrix: Aqueous

Date Sampled: 04/02/2024 1715 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1943 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1340 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | UH | 3.7 | 2.1 | 0.82 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | UH | 3.7 | 2.0 | 0.63 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | UH | 3.7 | 2.1 | 0.62 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | UH | 3.7 | 1.4 | 0.57 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | UH | 3.7 | 1.4 | 0.37 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.3 | UH | 4.7 | 4.3 | 1.9 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | UH | 23 | 9.2 | 4.0 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | UH | 3.7 | 2.2 | 0.93 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | UH | 0.93 | 0.37 | 0.12 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | UH | 0.93 | 0.74 | 0.27 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | UH | 9.3 | 1.9 | 0.57 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | UH | 0.93 | 0.74 | 0.20 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | UH | 0.93 | 0.74 | 0.28 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | UH | 9.3 | 1.9 | 0.59 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UH | 1.9 | 1.2 | 0.54 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | UH | 1.9 | 1.0 | 0.34 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | UH | 1.9 | 0.61 | 0.17 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UH | 1.9 | 1.2 | 0.36 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 2.6 | HM-03 | 0.93 | 0.33 | 0.088 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 4.3 | H | 3.7 | 1.5 | 0.48 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | UH | 0.93 | 0.36 | 0.15 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.37 | UH | 0.93 | 0.37 | 0.13 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | UH | 0.93 | 0.36 | 0.14 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | UH | 0.93 | 0.37 | 0.10 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.8 | HM-03 | 0.93 | 0.35 | 0.18 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 3.1 | HM-03 | 0.93 | 0.74 | 0.20 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | UH | 23 | 9.2 | 3.9 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 55 | HM-03 | 0.93 | 0.68 | 0.17 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 4.5 | H | 0.93 | 0.37 | 0.13 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | UH | 0.93 | 0.35 | 0.14 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.23 | HJM-03 | 0.93 | 0.37 | 0.096 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.37 | UH | 0.93 | 0.37 | 0.19 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 90 | HM-03 | 0.93 | 0.69 | 0.23 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 4.6 | HM-03 | 0.93 | 0.74 | 0.20 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 6.4 | HM-03 | 0.93 | 0.70 | 0.24 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 3.4 | H | 1.9 | 0.38 | 0.17 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | UH | 4.7 | 1.9 | 0.56 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | UH | 0.93 | 0.74 | 0.25 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | UH | 0.93 | 0.37 | 0.18 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | UH | 0.93 | 0.74 | 0.23 | ng/L | 2 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-016
Description: VRTB-D-Y3_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1715
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 | H | 91 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 | H | 90 | 20-150 |
| 13C2-8:2FTS | | 84 | 20-150 | HM-03 | 84 | 20-150 |
| 13C2-PFDoA | | 73 | 20-150 | H | 57 | 20-150 |
| 13C2-PFTeDA | | 43 | 20-150 | H | 35 | 20-150 |
| 13C3-HFPO-DA | | 84 | 20-150 | H | 89 | 20-150 |
| 13C3-PFBS | | 94 | 20-150 | H | 95 | 20-150 |
| 13C3-PFHxS | | 88 | 20-150 | H | 91 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 | H | 88 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 | H | 85 | 20-150 |
| 13C5-PFHxA | | 86 | 20-150 | H | 87 | 20-150 |
| 13C5-PFPeA | | 88 | 20-150 | H | 88 | 20-150 |
| 13C6-PFDA | | 93 | 20-150 | H | 79 | 20-150 |
| 13C7-PFUnA | | 84 | 20-150 | H | 77 | 20-150 |
| 13C8-PFOA | | 84 | 20-150 | H | 91 | 20-150 |
| 13C8-PFOS | | 86 | 20-150 | H | 84 | 20-150 |
| 13C8-PFOSA | | 72 | 20-150 | H | 78 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 | H | 81 | 20-150 |
| D3-NMeFOSA | M-03 | 65 | 20-150 | H | 56 | 20-150 |
| D3-NMeFOSAA | | 82 | 20-150 | H | 64 | 20-150 |
| D5-NEtFOSA | | 59 | 20-150 | H | 53 | 20-150 |
| D5-NEtFOSAA | | 81 | 20-150 | H | 58 | 20-150 |
| D7-NMeFOSE | | 65 | 20-150 | H | 63 | 20-150 |
| D9-NEtFOSE | | 61 | 20-150 | H | 54 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-017
Description: VRTB-D-G4_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1805 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1953 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1350 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.77 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 1.1 | M-03 | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 5.8 | M-03 | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.7 | M-03 | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 3.7 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 46 | M-03 | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 8.1 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.61 | JM-03 | 0.89 | 0.36 | 0.091 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 140 | BLM-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 3.9 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 1.4 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 8.6 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-017
Description: VRTB-D-G4_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1805
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 | H | 85 | 20-150 |
| 13C2-6:2FTS | | 87 | 20-150 | H | 86 | 20-150 |
| 13C2-8:2FTS | | 77 | 20-150 | H | 74 | 20-150 |
| 13C2-PFDoA | | 85 | 20-150 | H | 57 | 20-150 |
| 13C2-PFTeDA | | 68 | 20-150 | H | 60 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 | H | 89 | 20-150 |
| 13C3-PFBS | | 89 | 20-150 | H | 83 | 20-150 |
| 13C3-PFHxS | | 96 | 20-150 | H | 85 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | H | 88 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 | H | 88 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 | H | 93 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 | H | 90 | 20-150 |
| 13C6-PFDA | | 94 | 20-150 | H | 69 | 20-150 |
| 13C7-PFUnA | | 86 | 20-150 | H | 61 | 20-150 |
| 13C8-PFOA | | 90 | 20-150 | H | 91 | 20-150 |
| 13C8-PFOS | | 87 | 20-150 | H | 78 | 20-150 |
| 13C8-PFOSA | | 75 | 20-150 | H | 64 | 20-150 |
| 13C9-PFNA | | 90 | 20-150 | H | 81 | 20-150 |
| D3-NMeFOSA | | 63 | 20-150 | H | 47 | 20-150 |
| D3-NMeFOSAA | | 83 | 20-150 | H | 55 | 20-150 |
| D5-NEtFOSA | | 64 | 20-150 | H | 46 | 20-150 |
| D5-NEtFOSAA | | 82 | 20-150 | H | 55 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 | H | 54 | 20-150 |
| D9-NEtFOSE | | 67 | 20-150 | H | 53 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-017
Description: VRTB-D-G4_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 1805 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 1953 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1350 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 8.1 | UH | 14 | 8.1 | 3.1 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 7.7 | UH | 14 | 7.7 | 2.4 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 8.1 | UH | 14 | 8.1 | 2.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 5.3 | UH | 14 | 5.3 | 2.1 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 5.3 | UH | 14 | 5.3 | 1.4 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 17 | UH | 18 | 17 | 7.1 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 35 | UH | 88 | 35 | 15 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 8.4 | UH | 14 | 8.4 | 3.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.4 | UH | 3.5 | 1.4 | 0.45 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 2.8 | UH | 3.5 | 2.8 | 1.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 7.0 | UH | 35 | 7.0 | 2.2 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 2.8 | UH | 3.5 | 2.8 | 0.76 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 2.8 | UH | 3.5 | 2.8 | 1.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 7.0 | UH | 35 | 7.0 | 2.2 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 4.6 | UH | 7.0 | 4.6 | 2.0 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 3.9 | UH | 7.0 | 3.9 | 1.3 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 2.2 | UH | 7.0 | 2.2 | 0.65 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 4.6 | UH | 7.0 | 4.6 | 1.4 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 0.99 | HJM-03 | 3.5 | 1.2 | 0.33 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 5.2 | HJM-03 | 14 | 5.6 | 1.8 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.4 | UH | 3.5 | 1.4 | 0.58 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.4 | UH | 3.5 | 1.4 | 0.48 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.4 | UH | 3.5 | 1.4 | 0.54 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.4 | UH | 3.5 | 1.4 | 0.38 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.5 | HJM-03 | 3.5 | 1.3 | 0.67 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 3.3 | HJM-03 | 3.5 | 2.8 | 0.75 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 35 | UH | 88 | 35 | 15 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 42 | H | 3.5 | 2.6 | 0.65 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 6.9 | HM-03 | 3.5 | 1.4 | 0.50 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.3 | UH | 3.5 | 1.3 | 0.51 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.4 | UH | 3.5 | 1.4 | 0.36 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.4 | UH | 3.5 | 1.4 | 0.70 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 120 | HM-03 | 3.5 | 2.6 | 0.87 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 4.0 | HM-03 | 3.5 | 2.8 | 0.74 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 2.6 | UHM-03 | 3.5 | 2.6 | 0.91 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 7.1 | HM-03 | 7.0 | 1.4 | 0.65 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 7.2 | UH | 18 | 7.2 | 2.1 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 2.8 | UH | 3.5 | 2.8 | 0.95 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.4 | UH | 3.5 | 1.4 | 0.68 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 2.8 | UH | 3.5 | 2.8 | 0.87 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-017
Description: VRTB-D-G4_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024 1805
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 | H | 85 | 20-150 |
| 13C2-6:2FTS | | 87 | 20-150 | H | 86 | 20-150 |
| 13C2-8:2FTS | | 77 | 20-150 | H | 74 | 20-150 |
| 13C2-PFDoA | | 85 | 20-150 | H | 57 | 20-150 |
| 13C2-PFTeDA | | 68 | 20-150 | H | 60 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 | H | 89 | 20-150 |
| 13C3-PFBS | | 89 | 20-150 | H | 83 | 20-150 |
| 13C3-PFHxS | | 96 | 20-150 | H | 85 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | H | 88 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 | H | 88 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 | H | 93 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 | H | 90 | 20-150 |
| 13C6-PFDA | | 94 | 20-150 | H | 69 | 20-150 |
| 13C7-PFUnA | | 86 | 20-150 | H | 61 | 20-150 |
| 13C8-PFOA | | 90 | 20-150 | H | 91 | 20-150 |
| 13C8-PFOS | | 87 | 20-150 | H | 78 | 20-150 |
| 13C8-PFOSA | | 75 | 20-150 | H | 64 | 20-150 |
| 13C9-PFNA | | 90 | 20-150 | H | 81 | 20-150 |
| D3-NMeFOSA | | 63 | 20-150 | H | 47 | 20-150 |
| D3-NMeFOSAA | | 83 | 20-150 | H | 55 | 20-150 |
| D5-NEtFOSA | | 64 | 20-150 | H | 46 | 20-150 |
| D5-NEtFOSAA | | 82 | 20-150 | H | 55 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 | H | 54 | 20-150 |
| D9-NEtFOSE | | 67 | 20-150 | H | 53 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-018
Description: VRTB-D-M5_04032024 | Matrix: Aqueous
Date Sampled: 04/03/2024 1230 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 2011 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1359 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.81 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.62 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.2 | U | 4.6 | 4.2 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.92 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.59 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 3.2 | M-03 | 0.93 | 0.33 | 0.087 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 7.7 | M-03 | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.099 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 4.6 | M-03 | 0.93 | 0.35 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 7.2 | | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 82 | M-03 | 0.93 | 0.68 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 13 | M-03 | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.93 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.3 | M-03 | 0.93 | 0.37 | 0.096 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 280 | M-03 | 0.92 | 0.68 | 0.23 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 9.2 | M-03 | 0.93 | 0.74 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 3.8 | M-03 | 0.93 | 0.70 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 11 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-018
Description: VRTB-D-M5_04032024
Matrix: Aqueous
Date Sampled: 04/03/2024 1230
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | M-03 | 91 | 20-150 | | 102 | 20-150 |
| 13C2-6:2FTS | | 86 | 20-150 | | 101 | 20-150 |
| 13C2-8:2FTS | | 77 | 20-150 | | 84 | 20-150 |
| 13C2-PFDoA | | 75 | 20-150 | | 59 | 20-150 |
| 13C2-PFTeDA | | 65 | 20-150 | | 45 | 20-150 |
| 13C3-HFPO-DA | | 79 | 20-150 | | 91 | 20-150 |
| 13C3-PFBS | | 95 | 20-150 | | 96 | 20-150 |
| 13C3-PFHxS | | 98 | 20-150 | | 103 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 | | 95 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 | | 95 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 | | 95 | 20-150 |
| 13C5-PFPeA | | 93 | 20-150 | | 94 | 20-150 |
| 13C6-PFDA | | 89 | 20-150 | | 86 | 20-150 |
| 13C7-PFUnA | | 86 | 20-150 | | 73 | 20-150 |
| 13C8-PFOA | | 77 | 20-150 | | 108 | 20-150 |
| 13C8-PFOS | | 88 | 20-150 | | 87 | 20-150 |
| 13C8-PFOSA | | 74 | 20-150 | | 78 | 20-150 |
| 13C9-PFNA | M-03 | 92 | 20-150 | | 94 | 20-150 |
| D3-NMeFOSA | | 67 | 20-150 | | 63 | 20-150 |
| D3-NMeFOSAA | | 79 | 20-150 | | 70 | 20-150 |
| D5-NEtFOSA | | 66 | 20-150 | | 55 | 20-150 |
| D5-NEtFOSAA | | 80 | 20-150 | | 63 | 20-150 |
| D7-NMeFOSE | | 65 | 20-150 | | 58 | 20-150 |
| D9-NEtFOSE | | 61 | 20-150 | | 48 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-019
Description: VRTB-D-06_04032024 | Matrix: Aqueous
Date Sampled: 04/03/2024 1320 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 2020 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1408 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.80 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.61 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.56 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.2 | U | 4.6 | 4.2 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.91 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.1 | 1.8 | 0.56 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.1 | 1.8 | 0.58 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.53 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 2.4 | M-03 | 0.91 | 0.32 | 0.086 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.1 | M-03 | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.91 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.91 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.098 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 7.0 | M-03 | 0.91 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 7.9 | | 0.91 | 0.73 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.8 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 110 | M-03 | 0.91 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 14 | M-03 | 0.91 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.91 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.5 | M-03 | 0.91 | 0.36 | 0.094 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | UM-03 | 0.91 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 300 | M-03 | 0.94 | 0.70 | 0.23 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 9.6 | M-03 | 0.91 | 0.73 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 4.7 | | 0.91 | 0.68 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 9.6 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-019
Description: VRTB-D-06_04032024
Matrix: Aqueous
Date Sampled: 04/03/2024 1320
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 20-150 | | 93 | 20-150 |
| 13C2-6:2FTS | | 80 | 20-150 | | 95 | 20-150 |
| 13C2-8:2FTS | | 66 | 20-150 | | 71 | 20-150 |
| 13C2-PFDoA | | 73 | 20-150 | | 58 | 20-150 |
| 13C2-PFTeDA | | 48 | 20-150 | | 37 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 90 | 20-150 |
| 13C3-PFBS | | 87 | 20-150 | | 90 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 | | 88 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | | 88 | 20-150 |
| 13C4-PFHpA | | 88 | 20-150 | | 87 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 | | 88 | 20-150 |
| 13C5-PFPeA | | 92 | 20-150 | | 87 | 20-150 |
| 13C6-PFDA | | 76 | 20-150 | | 77 | 20-150 |
| 13C7-PFUnA | | 77 | 20-150 | | 69 | 20-150 |
| 13C8-PFOA | | 90 | 20-150 | | 102 | 20-150 |
| 13C8-PFOS | | 90 | 20-150 | | 76 | 20-150 |
| 13C8-PFOSA | | 73 | 20-150 | | 71 | 20-150 |
| 13C9-PFNA | | 86 | 20-150 | | 83 | 20-150 |
| D3-NMeFOSA | | 67 | 20-150 | | 56 | 20-150 |
| D3-NMeFOSAA | | 86 | 20-150 | | 64 | 20-150 |
| D5-NEtFOSA | | 65 | 20-150 | | 49 | 20-150 |
| D5-NEtFOSAA | | 75 | 20-150 | | 56 | 20-150 |
| D7-NMeFOSE | | 71 | 20-150 | | 39 | 20-150 |
| D9-NEtFOSE | | 67 | 20-150 | N | 19 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-020

Description: VRTB-D-R7_04032024 | Matrix: Aqueous

Date Sampled: 04/03/2024 1420 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 2029 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1417 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.4 | U | 4.2 | 2.4 | 0.91 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.3 | U | 4.2 | 2.3 | 0.70 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.4 | U | 4.2 | 2.4 | 0.69 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.6 | U | 4.2 | 1.6 | 0.64 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.6 | U | 4.2 | 1.6 | 0.42 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.8 | U | 5.2 | 4.8 | 2.1 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 10 | U | 26 | 10 | 4.5 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.5 | U | 4.2 | 2.5 | 1.0 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.13 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.30 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 2.0 | U | 10 | 2.0 | 0.64 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.23 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.31 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 2.0 | U | 10 | 2.0 | 0.66 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.4 | U | 2.1 | 1.4 | 0.60 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.2 | U | 2.1 | 1.2 | 0.38 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.67 | U | 2.1 | 0.67 | 0.19 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.4 | U | 2.1 | 1.4 | 0.41 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 8.5 | | 1.0 | 0.35 | 0.098 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 11 | | 4.2 | 1.7 | 0.53 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.17 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.14 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.39 | U | 1.0 | 0.39 | 0.16 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 2.3 | M-03 | 1.0 | 0.38 | 0.20 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 23 | | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 10 | U | 26 | 10 | 4.4 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 85 | M-03 | 1.0 | 0.73 | 0.19 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 20 | M-03 | 1.0 | 0.40 | 0.15 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.38 | U | 1.0 | 0.38 | 0.15 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.7 | M-03 | 1.0 | 0.40 | 0.11 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.21 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 97 | M-03 | 0.91 | 0.67 | 0.22 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 16 | M-03 | 1.0 | 0.80 | 0.22 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 2.2 | | 1.0 | 0.75 | 0.27 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 21 | M-03 | 2.1 | 0.42 | 0.19 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 2.1 | U | 5.2 | 2.1 | 0.62 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.28 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.40 | U | 1.0 | 0.40 | 0.20 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.80 | U | 1.0 | 0.80 | 0.26 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-020
Description: VRTB-D-R7_04032024
Matrix: Aqueous
Date Sampled: 04/03/2024 1420
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 87 | 20-150 | M-03 | 94 | 20-150 |
| 13C2-6:2FTS | M-03 | 80 | 20-150 | | 95 | 20-150 |
| 13C2-8:2FTS | | 83 | 20-150 | | 80 | 20-150 |
| 13C2-PFDoA | | 74 | 20-150 | | 69 | 20-150 |
| 13C2-PFTeDA | | 57 | 20-150 | | 46 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 | | 89 | 20-150 |
| 13C3-PFBS | | 85 | 20-150 | | 93 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 | | 97 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 | | 91 | 20-150 |
| 13C4-PFHpA | | 78 | 20-150 | | 91 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 | | 88 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 | | 87 | 20-150 |
| 13C6-PFDA | | 92 | 20-150 | | 88 | 20-150 |
| 13C7-PFUnA | | 80 | 20-150 | | 77 | 20-150 |
| 13C8-PFOA | | 90 | 20-150 | | 86 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 | | 90 | 20-150 |
| 13C8-PFOSA | | 72 | 20-150 | | 80 | 20-150 |
| 13C9-PFNA | | 75 | 20-150 | | 86 | 20-150 |
| D3-NMeFOSA | | 57 | 20-150 | | 59 | 20-150 |
| D3-NMeFOSAA | | 71 | 20-150 | | 70 | 20-150 |
| D5-NEtFOSA | | 55 | 20-150 | | 55 | 20-150 |
| D5-NEtFOSAA | | 74 | 20-150 | | 64 | 20-150 |
| D7-NMeFOSE | | 62 | 20-150 | | 60 | 20-150 |
| D9-NEtFOSE | | 59 | 20-150 | | 51 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-021
Description: VRTB-D-P8_04032024 | Matrix: Aqueous
Date Sampled: 04/03/2024 1525 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 2334 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1426 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.80 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.61 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.56 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.2 | U | 4.6 | 4.2 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.91 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.2 | 1.8 | 0.56 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.2 | 1.8 | 0.58 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.53 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | UM-03 | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.5 | | 0.92 | 0.32 | 0.086 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 14 | M-03 | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.92 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.92 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.098 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 3.3 | M-03 | 0.92 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 30 | | 0.92 | 0.74 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.8 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 160 | | 0.92 | 0.67 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 29 | | 0.92 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.92 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 7.5 | M-03 | 0.92 | 0.37 | 0.095 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 270 | M-03 | 0.93 | 0.69 | 0.23 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 25 | M-03 | 0.92 | 0.74 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 6.6 | | 0.92 | 0.69 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 28 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-021
Description: VRTB-D-P8_04032024
Matrix: Aqueous
Date Sampled: 04/03/2024 1525
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 80 | 20-150 | | 90 | 20-150 |
| 13C2-6:2FTS | | 80 | 20-150 | | 87 | 20-150 |
| 13C2-8:2FTS | | 81 | 20-150 | | 75 | 20-150 |
| 13C2-PFDoA | | 68 | 20-150 | | 59 | 20-150 |
| 13C2-PFTeDA | | 34 | 20-150 | | 37 | 20-150 |
| 13C3-HFPO-DA | | 80 | 20-150 | | 91 | 20-150 |
| 13C3-PFBS | | 86 | 20-150 | | 90 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 | | 88 | 20-150 |
| 13C4-PFBA | | 86 | 20-150 | | 91 | 20-150 |
| 13C4-PFHpA | | 76 | 20-150 | | 89 | 20-150 |
| 13C5-PFHxA | | 82 | 20-150 | | 90 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 | | 87 | 20-150 |
| 13C6-PFDA | | 83 | 20-150 | | 77 | 20-150 |
| 13C7-PFUnA | | 76 | 20-150 | | 71 | 20-150 |
| 13C8-PFOA | | 81 | 20-150 | | 104 | 20-150 |
| 13C8-PFOS | M-03 | 98 | 20-150 | | 91 | 20-150 |
| 13C8-PFOSA | | 79 | 20-150 | | 79 | 20-150 |
| 13C9-PFNA | | 88 | 20-150 | | 85 | 20-150 |
| D3-NMeFOSA | | 69 | 20-150 | | 63 | 20-150 |
| D3-NMeFOSAA | | 75 | 20-150 | | 71 | 20-150 |
| D5-NEtFOSA | | 62 | 20-150 | | 60 | 20-150 |
| D5-NEtFOSAA | | 75 | 20-150 | | 65 | 20-150 |
| D7-NMeFOSE | | 70 | 20-150 | | 64 | 20-150 |
| D9-NEtFOSE | | 62 | 20-150 | | 57 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-022
Description: VRTB-S-B1_04032024 | Matrix: Aqueous
Date Sampled: 04/03/2024 1620 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 2344 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1436 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.81 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.62 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.56 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.2 | U | 4.6 | 4.2 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.92 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.58 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.53 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 3.8 | | 0.93 | 0.33 | 0.087 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 5.2 | | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.099 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.0 | M-03 | 0.93 | 0.35 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 3.0 | M-03 | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 33 | | 0.93 | 0.68 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 5.8 | M-03 | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.93 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.34 | JM-03 | 0.93 | 0.37 | 0.095 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 130 | M-03 | 0.93 | 0.69 | 0.23 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 2.6 | | 0.93 | 0.74 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 2.2 | M-03 | 0.93 | 0.70 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 4.8 | M-03 | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-022
Description: VRTB-S-B1_04032024
Matrix: Aqueous
Date Sampled: 04/03/2024 1620
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 88 | 20-150 | | 86 | 20-150 |
| 13C2-6:2FTS | | 87 | 20-150 | | 92 | 20-150 |
| 13C2-8:2FTS | | 83 | 20-150 | | 81 | 20-150 |
| 13C2-PFDoA | | 65 | 20-150 | | 64 | 20-150 |
| 13C2-PFTeDA | | 53 | 20-150 | | 42 | 20-150 |
| 13C3-HFPO-DA | | 79 | 20-150 | | 92 | 20-150 |
| 13C3-PFBS | | 90 | 20-150 | | 89 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 | | 87 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 | | 88 | 20-150 |
| 13C4-PFHpA | | 79 | 20-150 | | 91 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 | | 91 | 20-150 |
| 13C5-PFPeA | | 83 | 20-150 | | 94 | 20-150 |
| 13C6-PFDA | | 76 | 20-150 | | 84 | 20-150 |
| 13C7-PFUnA | | 75 | 20-150 | | 75 | 20-150 |
| 13C8-PFOA | | 78 | 20-150 | | 96 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 | | 81 | 20-150 |
| 13C8-PFOSA | | 68 | 20-150 | | 75 | 20-150 |
| 13C9-PFNA | | 82 | 20-150 | | 81 | 20-150 |
| D3-NMeFOSA | | 57 | 20-150 | | 57 | 20-150 |
| D3-NMeFOSAA | | 75 | 20-150 | | 67 | 20-150 |
| D5-NEtFOSA | | 57 | 20-150 | | 55 | 20-150 |
| D5-NEtFOSAA | | 76 | 20-150 | | 62 | 20-150 |
| D7-NMeFOSE | | 62 | 20-150 | | 58 | 20-150 |
| D9-NEtFOSE | | 60 | 20-150 | | 51 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-023
Description: VRTB-S-S2_04032024 | Matrix: Aqueous
Date Sampled: 04/03/2024 1725 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/26/2024 2353 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1445 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 0.61 | JM-03 | 3.6 | 1.4 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.1 | U | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.55 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.6 | | 0.89 | 0.31 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 16 | | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 10 | | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 23 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 160 | M-03 | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 24 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.31 | JM-03 | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 20 | | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.86 | JM-03 | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 650 | M-03 | 5.0 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 39 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 7.7 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 25 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-023
Description: VRTB-S-S2_04032024
Matrix: Aqueous
Date Sampled: 04/03/2024 1725
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 32 | 20-150 | | 91 | 20-150 |
| 13C2-6:2FTS | | 33 | 20-150 | | 95 | 20-150 |
| 13C2-8:2FTS | | 30 | 20-150 | | 79 | 20-150 |
| 13C2-PFDoA | | 25 | 20-150 | | 64 | 20-150 |
| 13C2-PFTeDA | | 20 | 20-150 | | 58 | 20-150 |
| 13C3-HFPO-DA | | 30 | 20-150 | | 90 | 20-150 |
| 13C3-PFBS | | 32 | 20-150 | | 90 | 20-150 |
| 13C3-PFHxS | | 31 | 20-150 | | 93 | 20-150 |
| 13C4-PFBA | | 31 | 20-150 | | 90 | 20-150 |
| 13C4-PFHpA | | 30 | 20-150 | | 85 | 20-150 |
| 13C5-PFHxA | | 32 | 20-150 | | 91 | 20-150 |
| 13C5-PFPeA | | 32 | 20-150 | | 84 | 20-150 |
| 13C6-PFDA | | 27 | 20-150 | | 87 | 20-150 |
| 13C7-PFUnA | | 28 | 20-150 | | 68 | 20-150 |
| 13C8-PFOA | | 28 | 20-150 | | 108 | 20-150 |
| 13C8-PFOS | | 28 | 20-150 | | 79 | 20-150 |
| 13C8-PFOSA | | 28 | 20-150 | | 68 | 20-150 |
| 13C9-PFNA | | 32 | 20-150 | | 78 | 20-150 |
| D3-NMeFOSA | | 24 | 20-150 | | 57 | 20-150 |
| D3-NMeFOSAA | | 29 | 20-150 | M-03 | 64 | 20-150 |
| D5-NEtFOSA | | 23 | 20-150 | | 54 | 20-150 |
| D5-NEtFOSAA | | 28 | 20-150 | | 59 | 20-150 |
| D7-NMeFOSE | | 25 | 20-150 | | 59 | 20-150 |
| D9-NEtFOSE | | 23 | 20-150 | | 53 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-024
Description: VRTB-S-Y3_04032024 | Matrix: Aqueous
Date Sampled: 04/03/2024 1830 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/27/2024 0002 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 1 | 05/04/2024 1454 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.81 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.62 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 3.8 | M-03 | 3.7 | 1.4 | 0.56 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.2 | U | 4.6 | 4.2 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.92 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.2 | 1.8 | 0.56 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.2 | 1.8 | 0.58 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.53 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 7.6 | M-03 | 0.92 | 0.32 | 0.087 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 14 | M-03 | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.92 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.92 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.099 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 32 | | 0.92 | 0.35 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 12 | | 0.92 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 450 | M-03 | 0.92 | 0.67 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 30 | | 0.92 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.92 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 5.5 | M-03 | 0.92 | 0.37 | 0.095 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.5 | M-03 | 0.92 | 0.37 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1100 | M-03 | 5.0 | 3.7 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 23 | M-03 | 0.92 | 0.74 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 12 | M-03 | 0.92 | 0.69 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 21 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.92 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.92 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-024
Description: VRTB-S-Y3_04032024
Matrix: Aqueous
Date Sampled: 04/03/2024 1830
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 87 | 20-150 | | 90 | 20-150 |
| 13C2-6:2FTS | | 86 | 20-150 | | 94 | 20-150 |
| 13C2-8:2FTS | | 75 | 20-150 | | 71 | 20-150 |
| 13C2-PFDoA | | 76 | 20-150 | | 56 | 20-150 |
| 13C2-PFTeDA | | 47 | 20-150 | | 48 | 20-150 |
| 13C3-HFPO-DA | | 86 | 20-150 | | 87 | 20-150 |
| 13C3-PFBS | | 87 | 20-150 | | 93 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 | | 90 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 | | 90 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 | | 88 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 | | 90 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 | | 93 | 20-150 |
| 13C6-PFDA | | 82 | 20-150 | | 81 | 20-150 |
| 13C7-PFUnA | | 85 | 20-150 | | 69 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 | | 85 | 20-150 |
| 13C8-PFOS | | 83 | 20-150 | | 84 | 20-150 |
| 13C8-PFOSA | | 83 | 20-150 | | 62 | 20-150 |
| 13C9-PFNA | | 87 | 20-150 | | 86 | 20-150 |
| D3-NMeFOSA | | 59 | 20-150 | | 53 | 20-150 |
| D3-NMeFOSAA | | 94 | 20-150 | | 55 | 20-150 |
| D5-NEtFOSA | | 56 | 20-150 | | 48 | 20-150 |
| D5-NEtFOSAA | | 94 | 20-150 | | 52 | 20-150 |
| D7-NMeFOSE | | 66 | 20-150 | | 52 | 20-150 |
| D9-NEtFOSE | | 60 | 20-150 | | 49 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-025

Description: VRTB-S-G4_04032024 | Matrix: Aqueous

Date Sampled: 04/03/2024 1920 | Project Name: ESTCP Vertebrae

Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 04/27/2024 0011 | BWS | 04/25/2024 0811 | 10637 |
| 2 | 1633 | 1633 | 5 | 04/29/2024 1953 | ARC2 | 04/25/2024 0811 | 10637 |
| 3 | 1633 | 1633 | 1 | 05/04/2024 0504 | ARC2 | 05/01/2024 1538 | 10916 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.81 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.62 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.2 | U | 4.6 | 4.2 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.92 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.59 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.1 | M-03 | 0.93 | 0.33 | 0.087 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 7.2 | | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.099 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 24 | | 0.93 | 0.35 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 9.0 | | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 550 | M-03 | 4.6 | 3.4 | 0.86 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 21 | | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.93 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 2.6 | M-03 | 0.93 | 0.37 | 0.096 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 850 | | 5.0 | 3.7 | 1.2 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 18 | M-03 | 0.93 | 0.74 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 19 | | 0.93 | 0.70 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 9.5 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-025
Description: VRTB-S-G4_04032024
Matrix: Aqueous
Date Sampled: 04/03/2024 1920
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 20-150 | | 82 | 20-150 | | 84 | 20-150 |
| 13C2-6:2FTS | M-03 | 88 | 20-150 | | 73 | 20-150 | | 94 | 20-150 |
| 13C2-8:2FTS | | 88 | 20-150 | | 80 | 20-150 | | 70 | 20-150 |
| 13C2-PFDoA | | 80 | 20-150 | | 64 | 20-150 | | 54 | 20-150 |
| 13C2-PFTeDA | | 67 | 20-150 | | 58 | 20-150 | | 53 | 20-150 |
| 13C3-HFPO-DA | | 89 | 20-150 | | 85 | 20-150 | | 82 | 20-150 |
| 13C3-PFBS | | 89 | 20-150 | | 79 | 20-150 | | 86 | 20-150 |
| 13C3-PFHxS | | 91 | 20-150 | M-03 | 87 | 20-150 | | 85 | 20-150 |
| 13C4-PFBA | | 89 | 20-150 | | 88 | 20-150 | | 88 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 | | 86 | 20-150 | | 85 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 | | 81 | 20-150 | | 86 | 20-150 |
| 13C5-PFPeA | | 91 | 20-150 | | 91 | 20-150 | | 85 | 20-150 |
| 13C6-PFDA | | 86 | 20-150 | | 70 | 20-150 | | 66 | 20-150 |
| 13C7-PFUnA | | 86 | 20-150 | | 65 | 20-150 | | 52 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 | M-03 | 79 | 20-150 | | 95 | 20-150 |
| 13C8-PFOS | | 88 | 20-150 | | 94 | 20-150 | | 85 | 20-150 |
| 13C8-PFOSA | | 81 | 20-150 | | 72 | 20-150 | | 63 | 20-150 |
| 13C9-PFNA | | 90 | 20-150 | M-03 | 91 | 20-150 | | 74 | 20-150 |
| D3-NMeFOSA | | 71 | 20-150 | | 67 | 20-150 | | 49 | 20-150 |
| D3-NMeFOSAA | | 90 | 20-150 | | 83 | 20-150 | | 48 | 20-150 |
| D5-NEtFOSA | | 72 | 20-150 | | 67 | 20-150 | | 47 | 20-150 |
| D5-NEtFOSAA | | 89 | 20-150 | | 90 | 20-150 | | 54 | 20-150 |
| D7-NMeFOSE | | 80 | 20-150 | | 78 | 20-150 | | 53 | 20-150 |
| D9-NEtFOSE | | 77 | 20-150 | | 75 | 20-150 | | 48 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-026
Description: VRTB-L-B1_04042024 | Matrix: Aqueous
Date Sampled: 04/04/2024 0935 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0621 | BWS | 04/25/2024 1714 | 10632 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.81 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.62 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 0.94 | JM-03 | 3.7 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.2 | UM-03 | 4.6 | 4.2 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.92 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.59 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.0 | | 0.93 | 0.33 | 0.087 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 7.4 | M-03 | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.099 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 10 | M-03 | 0.93 | 0.35 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 7.8 | | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 130 | | 0.93 | 0.68 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 13 | | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.93 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 2.8 | M-03 | 0.93 | 0.37 | 0.096 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 530 | BM-03 | 0.93 | 0.69 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 21 | M-03 | 0.93 | 0.74 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.3 | M-03 | 0.93 | 0.70 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 9.2 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-026
Description: VRTB-L-B1_04042024
Matrix: Aqueous
Date Sampled: 04/04/2024 0935
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 92 | 20-150 |
| 13C2-6:2FTS | | 85 | 20-150 |
| 13C2-8:2FTS | | 74 | 20-150 |
| 13C2-PFDoA | | 47 | 20-150 |
| 13C2-PFTeDA | M-03 | 27 | 20-150 |
| 13C3-HFPO-DA | | 89 | 20-150 |
| 13C3-PFBS | | 86 | 20-150 |
| 13C3-PFHxS | | 88 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 |
| 13C5-PFHxA | | 85 | 20-150 |
| 13C5-PFPeA | | 92 | 20-150 |
| 13C6-PFDA | | 88 | 20-150 |
| 13C7-PFUnA | | 62 | 20-150 |
| 13C8-PFOA | | 86 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 |
| 13C8-PFOSA | | 75 | 20-150 |
| 13C9-PFNA | | 90 | 20-150 |
| D3-NMeFOSA | | 52 | 20-150 |
| D3-NMeFOSAA | | 56 | 20-150 |
| D5-NEtFOSA | | 49 | 20-150 |
| D5-NEtFOSAA | | 56 | 20-150 |
| D7-NMeFOSE | | 62 | 20-150 |
| D9-NEtFOSE | | 53 | 20-150 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-027
Description: VRTB-L-S2_04042024 | Matrix: Aqueous
Date Sampled: 04/04/2024 1015 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0630 | BWS | 04/25/2024 1714 | 10632 |
| 2 | 1633 | 1633 | 1 | 05/07/2024 1602 | ALM | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.83 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.64 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.63 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 6.4 | | 3.8 | 1.4 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.38 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 2.8 | J | 4.8 | 4.4 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.6 | U | 24 | 9.6 | 4.1 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.94 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.5 | 1.9 | 0.58 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.5 | 1.9 | 0.60 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.55 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.18 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.8 | M-03 | 0.95 | 0.33 | 0.089 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.3 | M-03 | 3.8 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.16 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.95 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 13 | | 0.95 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 9.2 | | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.6 | U | 24 | 9.6 | 4.0 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 150 | | 0.95 | 0.69 | 0.18 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 14 | M-03 | 0.95 | 0.38 | 0.14 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.36 | U | 0.95 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 4.7 | M-03 | 0.95 | 0.38 | 0.098 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.2 | M-03 | 0.95 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 770 | BESM-03 | 0.95 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 27 | M-03 | 0.95 | 0.76 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.5 | | 0.95 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 10 | M-03 | 1.9 | 0.38 | 0.18 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.8 | 1.9 | 0.57 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.26 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.95 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.76 | U | 0.95 | 0.76 | 0.24 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-027
Description: VRTB-L-S2_04042024
Matrix: Aqueous
Date Sampled: 04/04/2024 1015
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 | H | 80 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 | H | 78 | 20-150 |
| 13C2-8:2FTS | | 91 | 20-150 | H | 77 | 20-150 |
| 13C2-PFDoA | | 50 | 20-150 | H | 80 | 20-150 |
| 13C2-PFTeDA | | 37 | 20-150 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 89 | 20-150 | H | 87 | 20-150 |
| 13C3-PFBS | | 94 | 20-150 | H | 85 | 20-150 |
| 13C3-PFHxS | | 94 | 20-150 | H | 79 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | H | 84 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 | H | 89 | 20-150 |
| 13C5-PFHxA | | 86 | 20-150 | H | 89 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 | H | 85 | 20-150 |
| 13C6-PFDA | M-03 | 79 | 20-150 | H | 78 | 20-150 |
| 13C7-PFUnA | | 66 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOA | | 83 | 20-150 | H | 86 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 | H | 93 | 20-150 |
| 13C8-PFOSA | | 71 | 20-150 | H | 82 | 20-150 |
| 13C9-PFNA | M-03 | 88 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 54 | 20-150 | H | 59 | 20-150 |
| D3-NMeFOSAA | | 60 | 20-150 | H | 86 | 20-150 |
| D5-NEtFOSA | | 53 | 20-150 | H | 57 | 20-150 |
| D5-NEtFOSAA | | 59 | 20-150 | H | 75 | 20-150 |
| D7-NMeFOSE | | 58 | 20-150 | H | 77 | 20-150 |
| D9-NEtFOSE | | 48 | 20-150 | H | 76 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-027
Description: VRTB-L-S2_04042024 | Matrix: Aqueous
Date Sampled: 04/04/2024 1015 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0630 | BWS | 04/25/2024 1714 | 10632 |
| 2 | 1633 | 1633 | 1 | 05/07/2024 1602 | ALM | 05/03/2024 0750 | 11072 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 46 | UH | 80 | 46 | 17 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 44 | UH | 80 | 44 | 13 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 46 | UH | 80 | 46 | 13 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 30 | UH | 80 | 30 | 12 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 30 | UH | 80 | 30 | 8.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 92 | UH | 100 | 92 | 40 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 200 | UH | 500 | 200 | 86 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 48 | UH | 80 | 48 | 20 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.6 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 16 | UH | 20 | 16 | 5.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 40 | UH | 200 | 40 | 12 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 16 | UH | 20 | 16 | 4.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 16 | UH | 20 | 16 | 5.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 40 | UH | 200 | 40 | 13 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 26 | UH | 40 | 26 | 12 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 22 | UH | 40 | 22 | 7.2 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 13 | UH | 40 | 13 | 3.7 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 26 | UH | 40 | 26 | 7.8 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.6 | HJM-03 | 20 | 7.0 | 1.9 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 32 | UHM-03 | 80 | 32 | 10 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 7.8 | UH | 20 | 7.8 | 3.3 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.7 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 7.8 | UH | 20 | 7.8 | 3.1 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 8.0 | UH | 20 | 8.0 | 2.1 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 8.3 | HJM-03 | 20 | 7.6 | 3.8 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 5.8 | HJM-03 | 20 | 16 | 4.3 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 200 | UH | 500 | 200 | 84 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 160 | BHM-03 | 20 | 15 | 3.7 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 12 | HJM-03 | 20 | 8.0 | 2.8 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 7.6 | UH | 20 | 7.6 | 2.9 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 8.0 | UH | 20 | 8.0 | 2.1 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 5.1 | HJM-03 | 20 | 8.0 | 4.0 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 620 | BHM-03 | 20 | 15 | 4.9 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 24 | HM-03 | 20 | 16 | 4.2 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 8.6 | HJM-03 | 20 | 15 | 5.1 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 8.0 | UH | 40 | 8.0 | 3.7 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 40 | UH | 100 | 40 | 12 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 16 | UH | 20 | 16 | 5.4 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 8.0 | UH | 20 | 8.0 | 3.9 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 16 | UH | 20 | 16 | 5.0 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-027
Description: VRTB-L-S2_04042024
Matrix: Aqueous
Date Sampled: 04/04/2024 1015
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 | H | 80 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 | H | 78 | 20-150 |
| 13C2-8:2FTS | | 91 | 20-150 | H | 77 | 20-150 |
| 13C2-PFDoA | | 50 | 20-150 | H | 80 | 20-150 |
| 13C2-PFTeDA | | 37 | 20-150 | H | 76 | 20-150 |
| 13C3-HFPO-DA | | 89 | 20-150 | H | 87 | 20-150 |
| 13C3-PFBS | | 94 | 20-150 | H | 85 | 20-150 |
| 13C3-PFHxS | | 94 | 20-150 | H | 79 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | H | 84 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 | H | 89 | 20-150 |
| 13C5-PFHxA | | 86 | 20-150 | H | 89 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 | H | 85 | 20-150 |
| 13C6-PFDA | M-03 | 79 | 20-150 | H | 78 | 20-150 |
| 13C7-PFUnA | | 66 | 20-150 | H | 83 | 20-150 |
| 13C8-PFOA | | 83 | 20-150 | H | 86 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 | H | 93 | 20-150 |
| 13C8-PFOSA | | 71 | 20-150 | H | 82 | 20-150 |
| 13C9-PFNA | M-03 | 88 | 20-150 | H | 82 | 20-150 |
| D3-NMeFOSA | | 54 | 20-150 | H | 59 | 20-150 |
| D3-NMeFOSAA | | 60 | 20-150 | H | 86 | 20-150 |
| D5-NEtFOSA | | 53 | 20-150 | H | 57 | 20-150 |
| D5-NEtFOSAA | | 59 | 20-150 | H | 75 | 20-150 |
| D7-NMeFOSE | | 58 | 20-150 | H | 77 | 20-150 |
| D9-NEtFOSE | | 48 | 20-150 | H | 76 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-028
Description: VRTB-L-Y3_04042024 | Matrix: Aqueous
Date Sampled: 04/04/2024 1105 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0658 | BWS | 04/25/2024 1714 | 10632 |
| 2 | 1633 | 1633 | 5 | 05/03/2024 0007 | BWS | 04/25/2024 1714 | 10632 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.82 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.1 | U | 3.8 | 2.1 | 0.63 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.2 | U | 3.8 | 2.2 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 46 | | 3.8 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.8 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.5 | J | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.3 | U | 3.8 | 2.3 | 0.93 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.4 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.28 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.4 | 1.9 | 0.59 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | UM-03 | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.37 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 4.2 | M-03 | 0.94 | 0.33 | 0.088 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.9 | | 3.8 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.37 | U | 0.94 | 0.37 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 15 | M-03 | 0.94 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 12 | | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 140 | M-03 | 0.94 | 0.69 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 13 | | 0.94 | 0.38 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.26 | JM-03 | 0.94 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 6.4 | M-03 | 0.94 | 0.38 | 0.097 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.1 | M-03 | 0.94 | 0.38 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1200 | BM-03 | 4.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 24 | M-03 | 0.94 | 0.75 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 6.0 | M-03 | 0.94 | 0.71 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 12 | M-03 | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.56 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.38 | U | 0.94 | 0.38 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.75 | U | 0.94 | 0.75 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-028
Description: VRTB-L-Y3_04042024
Matrix: Aqueous
Date Sampled: 04/04/2024 1105
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 77 | 20-150 | | 83 | 20-150 |
| 13C2-6:2FTS | | 84 | 20-150 | M-03 | 89 | 20-150 |
| 13C2-8:2FTS | | 66 | 20-150 | M-03 | 69 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 | | 47 | 20-150 |
| 13C2-PFTeDA | | 53 | 20-150 | | 53 | 20-150 |
| 13C3-HFPO-DA | | 83 | 20-150 | | 93 | 20-150 |
| 13C3-PFBS | | 82 | 20-150 | M-03 | 80 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 | M-03 | 88 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 | | 85 | 20-150 |
| 13C4-PFHpA | | 82 | 20-150 | | 89 | 20-150 |
| 13C5-PFHxA | | 85 | 20-150 | | 83 | 20-150 |
| 13C5-PFPeA | | 83 | 20-150 | | 89 | 20-150 |
| 13C6-PFDA | | 73 | 20-150 | | 72 | 20-150 |
| 13C7-PFUnA | | 64 | 20-150 | | 62 | 20-150 |
| 13C8-PFOA | | 73 | 20-150 | | 74 | 20-150 |
| 13C8-PFOS | | 79 | 20-150 | | 80 | 20-150 |
| 13C8-PFOSA | | 72 | 20-150 | | 61 | 20-150 |
| 13C9-PFNA | M-03 | 88 | 20-150 | M-03 | 86 | 20-150 |
| D3-NMeFOSA | | 62 | 20-150 | | 55 | 20-150 |
| D3-NMeFOSAA | | 67 | 20-150 | M-03 | 58 | 20-150 |
| D5-NEtFOSA | | 63 | 20-150 | | 50 | 20-150 |
| D5-NEtFOSAA | | 65 | 20-150 | M-03 | 58 | 20-150 |
| D7-NMeFOSE | | 70 | 20-150 | | 54 | 20-150 |
| D9-NEtFOSE | | 67 | 20-150 | | 54 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-029
Description: VRTB-L-G4_04042024 | Matrix: Aqueous
Date Sampled: 04/04/2024 1145 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 05/02/2024 0707 | BWS | 04/25/2024 1714 | 10632 |
| 2 | 1633 | 1633 | 10 | 05/03/2024 0035 | BWS | 04/25/2024 1714 | 10632 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.80 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.61 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 52 | M-03 | 3.7 | 1.4 | 0.56 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 20 | | 4.6 | 4.2 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.91 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.1 | 1.8 | 0.56 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.1 | 1.8 | 0.58 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.53 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.5 | M-03 | 0.91 | 0.32 | 0.086 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 17 | | 3.7 | 1.5 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.91 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.91 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.098 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 30 | | 0.91 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 32 | | 0.91 | 0.73 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.8 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 310 | | 0.91 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 34 | | 0.91 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.91 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 20 | M-03 | 0.91 | 0.36 | 0.094 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.9 | | 0.91 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 3200 | BM-03 | 9.1 | 6.7 | 2.3 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 55 | | 0.91 | 0.73 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.8 | M-03 | 0.91 | 0.68 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 29 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.55 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-029
Description: VRTB-L-G4_04042024
Matrix: Aqueous
Date Sampled: 04/04/2024 1145
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 | M-03 | 76 | 20-150 |
| 13C2-6:2FTS | | 93 | 20-150 | M-03 | 80 | 20-150 |
| 13C2-8:2FTS | M-03 | 85 | 20-150 | M-03 | 63 | 20-150 |
| 13C2-PFDoA | | 62 | 20-150 | M-03 | 66 | 20-150 |
| 13C2-PFTeDA | | 52 | 20-150 | | 65 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 | | 93 | 20-150 |
| 13C3-PFBS | | 93 | 20-150 | | 89 | 20-150 |
| 13C3-PFHxS | | 94 | 20-150 | | 92 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 | | 89 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 | M-03 | 91 | 20-150 |
| 13C5-PFHxA | | 89 | 20-150 | M-03 | 94 | 20-150 |
| 13C5-PFPeA | | 95 | 20-150 | | 93 | 20-150 |
| 13C6-PFDA | M-03 | 82 | 20-150 | M-03 | 95 | 20-150 |
| 13C7-PFUnA | M-03 | 67 | 20-150 | | 84 | 20-150 |
| 13C8-PFOA | | 85 | 20-150 | | 94 | 20-150 |
| 13C8-PFOS | | 77 | 20-150 | | 73 | 20-150 |
| 13C8-PFOSA | | 77 | 20-150 | M-03 | 61 | 20-150 |
| 13C9-PFNA | | 87 | 20-150 | M-03 | 74 | 20-150 |
| D3-NMeFOSA | | 68 | 20-150 | | 49 | 20-150 |
| D3-NMeFOSAA | | 76 | 20-150 | | 59 | 20-150 |
| D5-NEtFOSA | | 65 | 20-150 | | 43 | 20-150 |
| D5-NEtFOSAA | | 69 | 20-150 | M-03 | 55 | 20-150 |
| D7-NMeFOSE | | 76 | 20-150 | | 51 | 20-150 |
| D9-NEtFOSE | | 70 | 20-150 | | 48 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-030
Description: DUP-01_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 10 | 05/03/2024 0044 | BWS | 04/25/2024 1714 | 10632 |
| 3 | 1633 | 1633 | 1 | 05/13/2024 1950 | ARC2 | 05/11/2024 0844 | 11501 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 21 | U | 37 | 21 | 8.0 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 20 | U | 37 | 20 | 6.1 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 21 | U | 37 | 21 | 6.1 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 56 | | 37 | 14 | 5.6 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 14 | U | 37 | 14 | 3.6 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 130 | | 46 | 42 | 19 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 92 | U | 230 | 92 | 39 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 22 | U | 37 | 22 | 9.1 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.7 | U | 9.2 | 3.7 | 1.2 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.4 | U | 9.2 | 7.4 | 2.7 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 18 | U | 92 | 18 | 5.6 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.4 | U | 9.2 | 7.4 | 2.0 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.4 | U | 9.2 | 7.4 | 2.7 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 18 | U | 92 | 18 | 5.8 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 12 | U | 18 | 12 | 5.3 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 9.9 | U | 18 | 9.9 | 3.3 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 5.8 | U | 18 | 5.8 | 1.7 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 12 | U | 18 | 12 | 3.6 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 23 | | 9.2 | 3.2 | 0.86 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 45 | M-03 | 37 | 15 | 4.7 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.6 | U | 9.2 | 3.6 | 1.5 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.7 | U | 9.2 | 3.7 | 1.2 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.6 | U | 9.2 | 3.6 | 1.4 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.7 | U | 9.2 | 3.7 | 0.98 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 180 | | 9.2 | 3.5 | 1.7 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 140 | | 9.2 | 7.4 | 1.9 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 92 | U | 230 | 92 | 38 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2200 | M-03 | 9.2 | 6.7 | 1.7 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 220 | M-03 | 9.2 | 3.7 | 1.3 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.5 | U | 9.2 | 3.5 | 1.3 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 88 | M-03 | 9.2 | 3.7 | 0.94 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 4.1 | JM-03 | 9.2 | 3.7 | 1.8 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 24000 | BEM-03 | 9.2 | 6.8 | 2.3 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 270 | M-03 | 9.2 | 7.4 | 1.9 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 53 | | 9.2 | 6.9 | 2.4 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 120 | M-03 | 18 | 3.6 | 1.7 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 18 | U | 46 | 18 | 5.5 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.4 | U | 9.2 | 7.4 | 2.5 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.7 | U | 9.2 | 3.7 | 1.8 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.4 | U | 9.2 | 7.4 | 2.3 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-030
Description: DUP-01_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | M-03 | 88 | 20-150 | H | 96 | 20-150 |
| 13C2-6:2FTS | | 76 | 20-150 | H | 86 | 20-150 |
| 13C2-8:2FTS | M-03 | 74 | 20-150 | H | 87 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 | H | 90 | 20-150 |
| 13C2-PFTeDA | M-03 | 40 | 20-150 | H | 79 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | H | 90 | 20-150 |
| 13C3-PFBS | M-03 | 84 | 20-150 | H | 85 | 20-150 |
| 13C3-PFHxS | M-03 | 80 | 20-150 | H | 88 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 | H | 90 | 20-150 |
| 13C4-PFHpA | M-03 | 84 | 20-150 | H | 91 | 20-150 |
| 13C5-PFHxA | | 83 | 20-150 | H | 97 | 20-150 |
| 13C5-PFPeA | | 81 | 20-150 | H | 95 | 20-150 |
| 13C6-PFDA | M-03 | 87 | 20-150 | H | 96 | 20-150 |
| 13C7-PFUnA | | 64 | 20-150 | H | 93 | 20-150 |
| 13C8-PFOA | M-03 | 79 | 20-150 | H | 93 | 20-150 |
| 13C8-PFOS | M-03 | 73 | 20-150 | H | 86 | 20-150 |
| 13C8-PFOSA | | 76 | 20-150 | H | 93 | 20-150 |
| 13C9-PFNA | M-03 | 91 | 20-150 | H | 88 | 20-150 |
| D3-NMeFOSA | | 63 | 20-150 | H | 76 | 20-150 |
| D3-NMeFOSAA | M-03 | 64 | 20-150 | H | 91 | 20-150 |
| D5-NEtFOSA | | 54 | 20-150 | H | 77 | 20-150 |
| D5-NEtFOSAA | | 62 | 20-150 | H | 87 | 20-150 |
| D7-NMeFOSE | | 59 | 20-150 | H | 89 | 20-150 |
| D9-NEtFOSE | | 56 | 20-150 | H | 92 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-030
Description: DUP-01_04022024 | Matrix: Aqueous
Date Sampled: 04/02/2024 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 10 | 05/03/2024 0044 | BWS | 04/25/2024 1714 | 10632 |
| 3 | 1633 | 1633 | 1 | 05/13/2024 1950 | ARC2 | 05/11/2024 0844 | 11501 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | UH | 400 | 230 | 87 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | UH | 400 | 220 | 67 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | UH | 400 | 230 | 66 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 150 | UH | 400 | 150 | 61 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | UH | 400 | 150 | 40 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 460 | UH | 500 | 460 | 200 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | UH | 2500 | 1000 | 430 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | UH | 400 | 240 | 99 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | UH | 100 | 40 | 13 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | UH | 1000 | 200 | 61 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | UH | 100 | 80 | 22 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | UH | 1000 | 200 | 63 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | UH | 200 | 130 | 58 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | UH | 200 | 110 | 36 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | UHS | 200 | 64 | 18 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | UH | 200 | 130 | 39 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 24 | HJM-03 | 100 | 35 | 9.4 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 52 | HJ | 400 | 160 | 51 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | UH | 100 | 39 | 16 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | UH | 100 | 40 | 14 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | UH | 100 | 39 | 15 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | UH | 100 | 40 | 11 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 150 | HM-03 | 100 | 38 | 19 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 130 | H | 100 | 80 | 21 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | UH | 2500 | 1000 | 420 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2200 | H | 100 | 73 | 18 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 180 | H | 100 | 40 | 14 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | UH | 100 | 38 | 15 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 86 | HJM-03 | 100 | 40 | 10 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 40 | UH | 100 | 40 | 20 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 22000 | BHSM-03 | 100 | 74 | 25 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 300 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 61 | HJM-03 | 100 | 75 | 26 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 130 | HJM-03 | 200 | 40 | 18 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | UH | 500 | 200 | 60 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | UH | 100 | 80 | 27 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | UH | 100 | 40 | 19 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | UH | 100 | 80 | 25 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZD05031-030
Description: DUP-01_04022024
Matrix: Aqueous
Date Sampled: 04/02/2024
Project Name: ESTCP Vertebrae
Date Received: 04/05/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | M-03 | 88 | 20-150 | H | 96 | 20-150 |
| 13C2-6:2FTS | | 76 | 20-150 | H | 86 | 20-150 |
| 13C2-8:2FTS | M-03 | 74 | 20-150 | H | 87 | 20-150 |
| 13C2-PFDoA | | 60 | 20-150 | H | 90 | 20-150 |
| 13C2-PFTeDA | M-03 | 40 | 20-150 | H | 79 | 20-150 |
| 13C3-HFPO-DA | | 91 | 20-150 | H | 90 | 20-150 |
| 13C3-PFBS | M-03 | 84 | 20-150 | H | 85 | 20-150 |
| 13C3-PFHxS | M-03 | 80 | 20-150 | H | 88 | 20-150 |
| 13C4-PFBA | | 84 | 20-150 | H | 90 | 20-150 |
| 13C4-PFHpA | M-03 | 84 | 20-150 | H | 91 | 20-150 |
| 13C5-PFHxA | | 83 | 20-150 | H | 97 | 20-150 |
| 13C5-PFPeA | | 81 | 20-150 | H | 95 | 20-150 |
| 13C6-PFDA | M-03 | 87 | 20-150 | H | 96 | 20-150 |
| 13C7-PFUnA | | 64 | 20-150 | H | 93 | 20-150 |
| 13C8-PFOA | M-03 | 79 | 20-150 | H | 93 | 20-150 |
| 13C8-PFOS | M-03 | 73 | 20-150 | H | 86 | 20-150 |
| 13C8-PFOSA | | 76 | 20-150 | H | 93 | 20-150 |
| 13C9-PFNA | M-03 | 91 | 20-150 | H | 88 | 20-150 |
| D3-NMeFOSA | | 63 | 20-150 | H | 76 | 20-150 |
| D3-NMeFOSAA | M-03 | 64 | 20-150 | H | 91 | 20-150 |
| D5-NEtFOSA | | 54 | 20-150 | H | 77 | 20-150 |
| D5-NEtFOSAA | | 62 | 20-150 | H | 87 | 20-150 |
| D7-NMeFOSE | | 59 | 20-150 | H | 89 | 20-150 |
| D9-NEtFOSE | | 56 | 20-150 | H | 92 | 20-150 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZD05031-031
Description: DUP-02_04042024 | Matrix: Aqueous
Date Sampled: 04/04/2024 | Project Name: ESTCP Vertebrae
Date Received: 04/05/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 10 | 05/03/2024 0054 | BWS | 04/25/2024 1714 | 10632 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 22 | U | 38 | 22 | 8.2 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 21 | U | 38 | 21 | 6.3 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 22 | U | 38 | 22 | 6.2 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 64 | M-03 | 38 | 14 | 5.7 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 14 | U | 38 | 14 | 3.7 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 24 | JM-03 | 47 | 43 | 19 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 92 | U | 230 | 92 | 40 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 23 | U | 38 | 23 | 9.3 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.8 | U | 9.4 | 3.8 | 1.2 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.5 | U | 9.4 | 7.5 | 2.7 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 19 | U | 94 | 19 | 5.7 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.5 | U | 9.4 | 7.5 | 2.0 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.5 | U | 9.4 | 7.5 | 2.8 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 19 | U | 94 | 19 | 5.9 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 12 | U | 19 | 12 | 5.4 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 10 | U | 19 | 10 | 3.4 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 6.1 | U | 19 | 6.1 | 1.7 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 12 | U | 19 | 12 | 3.6 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.3 | J | 9.4 | 3.3 | 0.88 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 17 | JM-03 | 38 | 15 | 4.8 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.7 | U | 9.4 | 3.7 | 1.5 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.8 | U | 9.4 | 3.8 | 1.3 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.7 | U | 9.4 | 3.7 | 1.4 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.8 | U | 9.4 | 3.8 | 1.0 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 24 | M-03 | 9.4 | 3.6 | 1.8 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 34 | | 9.4 | 7.5 | 2.0 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 92 | U | 230 | 92 | 39 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 320 | | 9.4 | 6.9 | 1.7 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 32 | M-03 | 9.4 | 3.8 | 1.3 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.6 | U | 9.4 | 3.6 | 1.4 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 20 | M-03 | 9.4 | 3.8 | 0.97 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.8 | U | 9.4 | 3.8 | 1.9 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 3100 | BM-03 | 9.4 | 7.0 | 2.3 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 62 | M-03 | 9.4 | 7.5 | 2.0 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 11 | | 9.4 | 7.1 | 2.4 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 29 | M-03 | 19 | 3.8 | 1.7 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 19 | U | 47 | 19 | 5.6 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.5 | U | 9.4 | 7.5 | 2.5 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.8 | U | 9.4 | 3.8 | 1.8 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.5 | U | 9.4 | 7.5 | 2.3 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

| | | | |
|---|---|---|---|
| Client: Arcadis U.S., Inc. | | | Laboratory ID: ZD05031-031 |
| Description: DUP-02_04042024 | | | Matrix: Aqueous |
| Date Sampled: 04/04/2024 | | Project Name: ESTCP Vertebrae | |
| Date Received: 04/05/2024 | | Project Number: 30027244.00004 | |

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | M-03 | 74 | 20-150 |
| 13C2-6:2FTS | M-03 | 84 | 20-150 |
| 13C2-8:2FTS | M-03 | 61 | 20-150 |
| 13C2-PFDoA | M-03 | 67 | 20-150 |
| 13C2-PFTeDA | M-03 | 61 | 20-150 |
| 13C3-HFPO-DA | | 98 | 20-150 |
| 13C3-PFBS | M-03 | 73 | 20-150 |
| 13C3-PFHxS | | 72 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 |
| 13C4-PFHpA | | 86 | 20-150 |
| 13C5-PFHxA | M-03 | 89 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 |
| 13C6-PFDA | M-03 | 90 | 20-150 |
| 13C7-PFUnA | M-03 | 71 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 |
| 13C8-PFOS | | 88 | 20-150 |
| 13C8-PFOSA | M-03 | 73 | 20-150 |
| 13C9-PFNA | M-03 | 89 | 20-150 |
| D3-NMeFOSA | | 63 | 20-150 |
| D3-NMeFOSAA | | 78 | 20-150 |
| D5-NEtFOSA | | 64 | 20-150 |
| D5-NEtFOSAA | | 57 | 20-150 |
| D7-NMeFOSE | | 62 | 20-150 |
| D9-NEtFOSE | | 59 | 20-150 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: ZQ10620-001
Batch: 10620
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/24/2024 1716

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 04/25/2024 1402 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 04/25/2024 1402 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 04/25/2024 1402 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 04/25/2024 1402 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 04/25/2024 1402 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 04/25/2024 1402 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 04/25/2024 1402 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 04/25/2024 1402 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 04/25/2024 1402 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 04/25/2024 1402 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 04/25/2024 1402 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 04/25/2024 1402 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 04/25/2024 1402 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 04/25/2024 1402 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 04/25/2024 1402 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 04/25/2024 1402 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 04/25/2024 1402 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 04/25/2024 1402 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 04/25/2024 1402 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 04/25/2024 1402 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 04/25/2024 1402 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 04/25/2024 1402 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 04/25/2024 1402 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 04/25/2024 1402 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 04/25/2024 1402 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 04/25/2024 1402 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 04/25/2024 1402 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 04/25/2024 1402 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 04/25/2024 1402 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 04/25/2024 1402 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 04/25/2024 1402 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 04/25/2024 1402 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 04/25/2024 1402 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 04/25/2024 1402 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 04/25/2024 1402 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 04/25/2024 1402 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 04/25/2024 1402 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 04/25/2024 1402 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 04/25/2024 1402 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 04/25/2024 1402 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 96 | 20-150 |
| 13C2-6:2FTS | | 96 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MB

Sample ID: ZQ10620-001
Batch: 10620
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/24/2024 1716

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 97 | 20-150 |
| 13C2-PFDoA | | 98 | 20-150 |
| 13C2-PFTeDA | | 84 | 20-150 |
| 13C3-HFPO-DA | | 95 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 |
| 13C3-PFHxS | | 96 | 20-150 |
| 13C4-PFBA | | 94 | 20-150 |
| 13C4-PFHpA | | 99 | 20-150 |
| 13C5-PFHxA | | 96 | 20-150 |
| 13C5-PFPeA | | 100 | 20-150 |
| 13C6-PFDA | | 92 | 20-150 |
| 13C7-PFUnA | | 90 | 20-150 |
| 13C8-PFOA | | 100 | 20-150 |
| 13C8-PFOS | | 91 | 20-150 |
| 13C8-PFOSA | | 91 | 20-150 |
| 13C9-PFNA | | 96 | 20-150 |
| D3-NMeFOSA | | 83 | 20-150 |
| D3-NMeFOSAA | | 97 | 20-150 |
| D5-NEtFOSA | | 85 | 20-150 |
| D5-NEtFOSAA | | 95 | 20-150 |
| D7-NMeFOSE | | 94 | 20-150 |
| D9-NEtFOSE | | 92 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10620-002
Batch: 10620
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/24/2024 1716

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 81 | | 1 | 90 | 40-150 | 04/25/2024 1411 |
| 9Cl-PF3ONS | 90 | 92 | | 1 | 102 | 40-150 | 04/25/2024 1411 |
| ADONA | 91 | 96 | | 1 | 105 | 40-150 | 04/25/2024 1411 |
| 8:2FTS | 92 | 100 | | 1 | 110 | 40-150 | 04/25/2024 1411 |
| 4:2FTS | 90 | 110 | | 1 | 120 | 40-150 | 04/25/2024 1411 |
| 6:2FTS | 91 | 100 | | 1 | 110 | 40-150 | 04/25/2024 1411 |
| 5:3FTCA | 600 | 580 | | 1 | 97 | 40-150 | 04/25/2024 1411 |
| HFPO-DA | 96 | 99 | | 1 | 103 | 40-150 | 04/25/2024 1411 |
| NEtFOSA | 24 | 25 | | 1 | 104 | 40-150 | 04/25/2024 1411 |
| NEtFOSAA | 24 | 29 | M-03 | 1 | 122 | 40-150 | 04/25/2024 1411 |
| NEtFOSE | 240 | 260 | | 1 | 110 | 40-150 | 04/25/2024 1411 |
| NMeFOSA | 24 | 25 | | 1 | 104 | 40-150 | 04/25/2024 1411 |
| NMeFOSAA | 24 | 32 | M-03 | 1 | 134 | 40-150 | 04/25/2024 1411 |
| NMeFOSE | 240 | 260 | | 1 | 110 | 40-150 | 04/25/2024 1411 |
| NFDHA | 48 | 43 | | 1 | 90 | 40-150 | 04/25/2024 1411 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 38 | | 1 | 90 | 40-150 | 04/25/2024 1411 |
| PFMPA | 48 | 44 | | 1 | 91 | 40-150 | 04/25/2024 1411 |
| PFMBA | 48 | 41 | | 1 | 86 | 40-150 | 04/25/2024 1411 |
| PFBS | 21 | 24 | | 1 | 115 | 40-150 | 04/25/2024 1411 |
| PFBA | 96 | 110 | | 1 | 118 | 40-150 | 04/25/2024 1411 |
| PFDS | 23 | 24 | | 1 | 102 | 40-150 | 04/25/2024 1411 |
| PFDA | 24 | 28 | | 1 | 117 | 40-150 | 04/25/2024 1411 |
| PFDoS | 23 | 22 | | 1 | 93 | 40-150 | 04/25/2024 1411 |
| PFDoA | 24 | 28 | | 1 | 118 | 40-150 | 04/25/2024 1411 |
| PFHpS | 23 | 23 | | 1 | 100 | 40-150 | 04/25/2024 1411 |
| PFHpA | 24 | 27 | | 1 | 112 | 40-150 | 04/25/2024 1411 |
| 7:3FTCA | 600 | 540 | | 1 | 90 | 40-150 | 04/25/2024 1411 |
| PFHxS | 22 | 24 | | 1 | 109 | 40-150 | 04/25/2024 1411 |
| PFHxA | 24 | 26 | | 1 | 108 | 40-150 | 04/25/2024 1411 |
| PFNS | 23 | 25 | | 1 | 108 | 40-150 | 04/25/2024 1411 |
| PFNA | 24 | 29 | | 1 | 123 | 40-150 | 04/25/2024 1411 |
| PFOSA | 24 | 29 | M-03 | 1 | 120 | 40-150 | 04/25/2024 1411 |
| PFOS | 22 | 25 | M-03 | 1 | 111 | 40-150 | 04/25/2024 1411 |
| PFOA | 24 | 27 | | 1 | 111 | 40-150 | 04/25/2024 1411 |
| PFPeS | 23 | 26 | | 1 | 113 | 40-150 | 04/25/2024 1411 |
| PFPeA | 48 | 56 | | 1 | 118 | 40-150 | 04/25/2024 1411 |
| 3:3FTCA | 120 | 120 | | 1 | 96 | 40-150 | 04/25/2024 1411 |
| PFTeDA | 24 | 28 | | 1 | 117 | 40-150 | 04/25/2024 1411 |
| PFTrDA | 24 | 26 | | 1 | 109 | 40-150 | 04/25/2024 1411 |
| PFUnA | 24 | 29 | | 1 | 119 | 40-150 | 04/25/2024 1411 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 99 | 20-150 |
| 13C2-6:2FTS | | 100 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10620-002
Batch: 10620
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/24/2024 1716

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 106 | 20-150 |
| 13C2-PFDoA | | 96 | 20-150 |
| 13C2-PFTeDA | | 87 | 20-150 |
| 13C3-HFPO-DA | | 97 | 20-150 |
| 13C3-PFBS | | 103 | 20-150 |
| 13C3-PFHxS | | 105 | 20-150 |
| 13C4-PFBA | | 98 | 20-150 |
| 13C4-PFHpA | | 100 | 20-150 |
| 13C5-PFHxA | | 104 | 20-150 |
| 13C5-PFPeA | | 106 | 20-150 |
| 13C6-PFDA | | 95 | 20-150 |
| 13C7-PFUnA | | 96 | 20-150 |
| 13C8-PFOA | | 99 | 20-150 |
| 13C8-PFOS | | 101 | 20-150 |
| 13C8-PFOSA | | 91 | 20-150 |
| 13C9-PFNA | | 93 | 20-150 |
| D3-NMeFOSA | | 89 | 20-150 |
| D3-NMeFOSAA | | 92 | 20-150 |
| D5-NEtFOSA | | 92 | 20-150 |
| D5-NEtFOSAA | | 100 | 20-150 |
| D7-NMeFOSE | | 103 | 20-150 |
| D9-NEtFOSE | | 100 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10620-102
Batch: 10620
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/24/2024 1716

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 6.3 | | 1 | 84 | 40-150 | 04/25/2024 1421 |
| 9Cl-PF3ONS | 7.5 | 6.8 | | 1 | 90 | 40-150 | 04/25/2024 1421 |
| ADONA | 7.6 | 6.9 | | 1 | 91 | 40-150 | 04/25/2024 1421 |
| 8:2FTS | 7.7 | 7.0 | | 1 | 91 | 40-150 | 04/25/2024 1421 |
| 4:2FTS | 7.5 | 6.9 | | 1 | 92 | 40-150 | 04/25/2024 1421 |
| 6:2FTS | 7.6 | 7.0 | M-03 | 1 | 92 | 40-150 | 04/25/2024 1421 |
| 5:3FTCA | 50 | 41 | | 1 | 83 | 40-150 | 04/25/2024 1421 |
| HFPO-DA | 8.0 | 6.1 | M-03 | 1 | 76 | 40-150 | 04/25/2024 1421 |
| NEtFOSA | 2.0 | 1.5 | | 1 | 77 | 40-150 | 04/25/2024 1421 |
| NEtFOSAA | 2.0 | 2.1 | M-03 | 1 | 104 | 40-150 | 04/25/2024 1421 |
| NEtFOSE | 20 | 17 | | 1 | 87 | 40-150 | 04/25/2024 1421 |
| NMeFOSA | 2.0 | 1.7 | | 1 | 86 | 40-150 | 04/25/2024 1421 |
| NMeFOSAA | 2.0 | 1.7 | M-03 | 1 | 86 | 40-150 | 04/25/2024 1421 |
| NMeFOSE | 20 | 17 | | 1 | 87 | 40-150 | 04/25/2024 1421 |
| NFDHA | 4.0 | 3.4 | | 1 | 85 | 40-150 | 04/25/2024 1421 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.1 | | 1 | 86 | 40-150 | 04/25/2024 1421 |
| PFMPA | 4.0 | 3.4 | | 1 | 85 | 40-150 | 04/25/2024 1421 |
| PFMBA | 4.0 | 3.4 | M-03 | 1 | 86 | 40-150 | 04/25/2024 1421 |
| PFBS | 1.8 | 1.6 | M-03 | 1 | 90 | 40-150 | 04/25/2024 1421 |
| PFBA | 8.0 | 7.2 | | 1 | 90 | 40-150 | 04/25/2024 1421 |
| PFDS | 1.9 | 1.7 | | 1 | 90 | 40-150 | 04/25/2024 1421 |
| PFDA | 2.0 | 1.6 | M-03 | 1 | 80 | 40-150 | 04/25/2024 1421 |
| PFDoS | 1.9 | 1.5 | M-03 | 1 | 78 | 40-150 | 04/25/2024 1421 |
| PFDoA | 2.0 | 1.8 | | 1 | 91 | 40-150 | 04/25/2024 1421 |
| PFHpS | 1.9 | 1.8 | M-03 | 1 | 92 | 40-150 | 04/25/2024 1421 |
| PFHpA | 2.0 | 1.8 | M-03 | 1 | 92 | 40-150 | 04/25/2024 1421 |
| 7:3FTCA | 50 | 43 | | 1 | 85 | 40-150 | 04/25/2024 1421 |
| PFHxS | 1.8 | 1.5 | M-03 | 1 | 83 | 40-150 | 04/25/2024 1421 |
| PFHxA | 2.0 | 1.6 | M-03 | 1 | 81 | 40-150 | 04/25/2024 1421 |
| PFNS | 1.9 | 1.6 | | 1 | 83 | 40-150 | 04/25/2024 1421 |
| PFNA | 2.0 | 1.7 | M-03 | 1 | 86 | 40-150 | 04/25/2024 1421 |
| PFOSA | 2.0 | 1.8 | M-03 | 1 | 90 | 40-150 | 04/25/2024 1421 |
| PFOS | 1.9 | 2.2 | M-03 | 1 | 119 | 40-150 | 04/25/2024 1421 |
| PFOA | 2.0 | 1.8 | M-03 | 1 | 89 | 40-150 | 04/25/2024 1421 |
| PFPeS | 1.9 | 1.7 | M-03 | 1 | 90 | 40-150 | 04/25/2024 1421 |
| PFPeA | 4.0 | 3.8 | | 1 | 95 | 40-150 | 04/25/2024 1421 |
| 3:3FTCA | 10 | 9.2 | | 1 | 92 | 40-150 | 04/25/2024 1421 |
| PFTeDA | 2.0 | 1.8 | | 1 | 90 | 40-150 | 04/25/2024 1421 |
| PFTrDA | 2.0 | 1.7 | M-03 | 1 | 83 | 40-150 | 04/25/2024 1421 |
| PFUnA | 2.0 | 1.7 | M-03 | 1 | 86 | 40-150 | 04/25/2024 1421 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 108 | 20-150 |
| 13C2-6:2FTS | | 103 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10620-102
Batch: 10620
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/24/2024 1716

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 112 | 20-150 |
| 13C2-PFDoA | | 101 | 20-150 |
| 13C2-PFTeDA | | 85 | 20-150 |
| 13C3-HFPO-DA | | 107 | 20-150 |
| 13C3-PFBS | | 110 | 20-150 |
| 13C3-PFHxS | | 111 | 20-150 |
| 13C4-PFBA | | 105 | 20-150 |
| 13C4-PFHpA | | 103 | 20-150 |
| 13C5-PFHxA | | 111 | 20-150 |
| 13C5-PFPeA | | 112 | 20-150 |
| 13C6-PFDA | M-03 | 101 | 20-150 |
| 13C7-PFUnA | | 103 | 20-150 |
| 13C8-PFOA | | 115 | 20-150 |
| 13C8-PFOS | | 106 | 20-150 |
| 13C8-PFOSA | | 101 | 20-150 |
| 13C9-PFNA | | 108 | 20-150 |
| D3-NMeFOSA | | 91 | 20-150 |
| D3-NMeFOSAA | | 101 | 20-150 |
| D5-NEtFOSA | | 97 | 20-150 |
| D5-NEtFOSAA | | 105 | 20-150 |
| D7-NMeFOSE | | 104 | 20-150 |
| D9-NEtFOSE | | 100 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZD05031-003MS
Batch: 10620
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/24/2024 1716

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 84 | 62 | | 1 | 74 | 40-150 | 05/02/2024 0326 |
| 9Cl-PF3ONS | ND | 84 | 77 | | 1 | 92 | 40-150 | 05/02/2024 0326 |
| ADONA | ND | 84 | 81 | | 1 | 96 | 40-150 | 05/02/2024 0326 |
| 8:2FTS | 16 | 86 | 110 | M-03 | 1 | 114 | 40-150 | 05/02/2024 0326 |
| 4:2FTS | ND | 84 | 100 | | 1 | 119 | 40-150 | 05/02/2024 0326 |
| 6:2FTS | 21 | 85 | 120 | | 1 | 120 | 40-150 | 05/02/2024 0326 |
| 5:3FTCA | ND | 560 | 490 | | 1 | 88 | 40-150 | 05/02/2024 0326 |
| HFPO-DA | ND | 89 | 82 | | 1 | 92 | 40-150 | 05/02/2024 0326 |
| NEtFOSA | ND | 22 | 22 | | 1 | 98 | 40-150 | 05/02/2024 0326 |
| NEtFOSAA | ND | 22 | 27 | M-03 | 1 | 121 | 40-150 | 05/02/2024 0326 |
| NEtFOSE | ND | 220 | 240 | | 1 | 109 | 40-150 | 05/02/2024 0326 |
| NMeFOSA | ND | 22 | 23 | | 1 | 103 | 40-150 | 05/02/2024 0326 |
| NMeFOSAA | ND | 22 | 26 | M-03 | 1 | 117 | 40-150 | 05/02/2024 0326 |
| NMeFOSE | ND | 220 | 250 | | 1 | 113 | 40-150 | 05/02/2024 0326 |
| NFDHA | ND | 45 | 38 | | 1 | 86 | 40-150 | 05/02/2024 0326 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 40 | 33 | | 1 | 84 | 40-150 | 05/02/2024 0326 |
| PFMPA | ND | 45 | 39 | | 1 | 86 | 40-150 | 05/02/2024 0326 |
| PFMBA | ND | 45 | 37 | | 1 | 84 | 40-150 | 05/02/2024 0326 |
| PFBS | 6.4 | 20 | 29 | | 1 | 113 | 40-150 | 05/02/2024 0326 |
| PFBA | 15 | 89 | 120 | | 1 | 121 | 40-150 | 05/02/2024 0326 |
| PFDS | ND | 22 | 30 | | 1 | 139 | 40-150 | 05/02/2024 0326 |
| PFDA | ND | 22 | 27 | | 1 | 120 | 40-150 | 05/02/2024 0326 |
| PFDoS | ND | 22 | 27 | | 1 | 125 | 40-150 | 05/02/2024 0326 |
| PFDoA | ND | 22 | 26 | | 1 | 118 | 40-150 | 05/02/2024 0326 |
| PFHpS | 48 | 21 | 80 | | 1 | 147 | 40-150 | 05/02/2024 0326 |
| PFHpA | 26 | 22 | 54 | | 1 | 126 | 40-150 | 05/02/2024 0326 |
| 7:3FTCA | ND | 560 | 450 | | 1 | 82 | 40-150 | 05/02/2024 0326 |
| PFHxS | 400 | 20 | 420 | | 1 | 114 | 40-150 | 05/02/2024 0326 |
| PFHxA | 27 | 22 | 54 | | 1 | 118 | 40-150 | 05/02/2024 0326 |
| PFNS | ND | 21 | 32 | | 1 | 148 | 40-150 | 05/02/2024 0326 |
| PFNA | 28 | 22 | 58 | M-03 | 1 | 133 | 40-150 | 05/02/2024 0326 |
| PFOSA | 0.61 | 22 | 29 | M-03 | 1 | 127 | 40-150 | 05/02/2024 0326 |
| PFOS | 5800 | 21 | 5500 | NM-03 | 1 | -1310 | 40-150 | 05/02/2024 0326 |
| PFOA | 63 | 22 | 90 | M-03 | 1 | 120 | 40-150 | 05/02/2024 0326 |
| PFPeS | 8.6 | 21 | 33 | | 1 | 118 | 40-150 | 05/02/2024 0326 |
| PFPeA | 26 | 45 | 82 | | 1 | 126 | 40-150 | 05/02/2024 0326 |
| 3:3FTCA | ND | 110 | 94 | | 1 | 84 | 40-150 | 05/02/2024 0326 |
| PFTeDA | ND | 22 | 25 | | 1 | 111 | 40-150 | 05/02/2024 0326 |
| PFTrDA | ND | 22 | 23 | | 1 | 104 | 40-150 | 05/02/2024 0326 |
| PFUnA | ND | 22 | 24 | | 1 | 109 | 40-150 | 05/02/2024 0326 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 108 | 20-150 |
| 13C2-6:2FTS | | 99 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZD05031-003MS
Batch: 10620
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/24/2024 1716

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 111 | 20-150 |
| 13C2-PFDoA | | 92 | 20-150 |
| 13C2-PFTeDA | | 81 | 20-150 |
| 13C3-HFPO-DA | | 103 | 20-150 |
| 13C3-PFBS | | 107 | 20-150 |
| 13C3-PFHxS | | 105 | 20-150 |
| 13C4-PFBA | | 103 | 20-150 |
| 13C4-PFHpA | | 101 | 20-150 |
| 13C5-PFHxA | | 106 | 20-150 |
| 13C5-PFPeA | | 106 | 20-150 |
| 13C6-PFDA | | 103 | 20-150 |
| 13C7-PFUnA | | 94 | 20-150 |
| 13C8-PFOA | | 99 | 20-150 |
| 13C8-PFOS | | 96 | 20-150 |
| 13C8-PFOSA | | 128 | 20-150 |
| 13C9-PFNA | | 114 | 20-150 |
| D3-NMeFOSA | | 124 | 20-150 |
| D3-NMeFOSAA | | 124 | 20-150 |
| D5-NEtFOSA | | 127 | 20-150 |
| D5-NEtFOSAA | | 110 | 20-150 |
| D7-NMeFOSE | | 119 | 20-150 |
| D9-NEtFOSE | | 113 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ10632-001
Batch: 10632
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 1714

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 04/26/2024 1010 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 04/26/2024 1010 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 04/26/2024 1010 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 04/26/2024 1010 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 04/26/2024 1010 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 04/26/2024 1010 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 04/26/2024 1010 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 04/26/2024 1010 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 04/26/2024 1010 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 04/26/2024 1010 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 04/26/2024 1010 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 04/26/2024 1010 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 04/26/2024 1010 |
| NMeFOSE | 2.0 | UM-03 | 1 | 10 | 2.0 | 0.63 | ng/L | 04/26/2024 1010 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 04/26/2024 1010 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 04/26/2024 1010 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 04/26/2024 1010 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 04/26/2024 1010 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 04/26/2024 1010 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 04/26/2024 1010 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 04/26/2024 1010 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 04/26/2024 1010 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 04/26/2024 1010 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 04/26/2024 1010 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 04/26/2024 1010 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 04/26/2024 1010 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 04/26/2024 1010 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 04/26/2024 1010 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 04/26/2024 1010 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 04/26/2024 1010 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 04/26/2024 1010 |
| PFOSA | 0.40 | UM-03 | 1 | 1.0 | 0.40 | 0.20 | ng/L | 04/26/2024 1010 |
| PFOS | 0.25 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 04/26/2024 1010 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 04/26/2024 1010 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 04/26/2024 1010 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 04/26/2024 1010 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 04/26/2024 1010 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 04/26/2024 1010 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 04/26/2024 1010 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 04/26/2024 1010 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 79 | 20-150 |
| 13C2-6:2FTS | | 75 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ10632-001
Batch: 10632
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 1714

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 80 | 20-150 |
| 13C2-PFDoA | | 70 | 20-150 |
| 13C2-PFTeDA | | 66 | 20-150 |
| 13C3-HFPO-DA | | 78 | 20-150 |
| 13C3-PFBS | | 81 | 20-150 |
| 13C3-PFHxS | | 81 | 20-150 |
| 13C4-PFBA | | 79 | 20-150 |
| 13C4-PFHpA | | 78 | 20-150 |
| 13C5-PFHxA | | 81 | 20-150 |
| 13C5-PFPeA | | 80 | 20-150 |
| 13C6-PFDA | | 80 | 20-150 |
| 13C7-PFUnA | | 76 | 20-150 |
| 13C8-PFOA | | 69 | 20-150 |
| 13C8-PFOS | | 79 | 20-150 |
| 13C8-PFOSA | | 74 | 20-150 |
| 13C9-PFNA | | 79 | 20-150 |
| D3-NMeFOSA | | 59 | 20-150 |
| D3-NMeFOSAA | | 72 | 20-150 |
| D5-NEtFOSA | | 58 | 20-150 |
| D5-NEtFOSAA | | 72 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 |
| D9-NEtFOSE | | 67 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10632-002
Batch: 10632
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 1714

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 93 | | 1 | 102 | 40-150 | 04/26/2024 1019 |
| 9Cl-PF3ONS | 90 | 110 | | 1 | 125 | 40-150 | 04/26/2024 1019 |
| ADONA | 91 | 110 | | 1 | 122 | 40-150 | 04/26/2024 1019 |
| 8:2FTS | 92 | 98 | | 1 | 106 | 40-150 | 04/26/2024 1019 |
| 4:2FTS | 90 | 90 | | 1 | 100 | 40-150 | 04/26/2024 1019 |
| 6:2FTS | 91 | 94 | | 1 | 104 | 40-150 | 04/26/2024 1019 |
| 5:3FTCA | 600 | 670 | | 1 | 112 | 40-150 | 04/26/2024 1019 |
| HFPO-DA | 96 | 110 | | 1 | 119 | 40-150 | 04/26/2024 1019 |
| NEtFOSA | 24 | 24 | | 1 | 100 | 40-150 | 04/26/2024 1019 |
| NEtFOSAA | 24 | 23 | M-03 | 1 | 97 | 40-150 | 04/26/2024 1019 |
| NEtFOSE | 240 | 240 | | 1 | 101 | 40-150 | 04/26/2024 1019 |
| NMeFOSA | 24 | 24 | | 1 | 99 | 40-150 | 04/26/2024 1019 |
| NMeFOSAA | 24 | 25 | M-03 | 1 | 106 | 40-150 | 04/26/2024 1019 |
| NMeFOSE | 240 | 240 | | 1 | 102 | 40-150 | 04/26/2024 1019 |
| NFDHA | 48 | 54 | | 1 | 112 | 40-150 | 04/26/2024 1019 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 49 | | 1 | 115 | 40-150 | 04/26/2024 1019 |
| PFMPA | 48 | 58 | | 1 | 121 | 40-150 | 04/26/2024 1019 |
| PFMBA | 48 | 56 | | 1 | 116 | 40-150 | 04/26/2024 1019 |
| PFBS | 21 | 23 | | 1 | 108 | 40-150 | 04/26/2024 1019 |
| PFBA | 96 | 110 | | 1 | 109 | 40-150 | 04/26/2024 1019 |
| PFDS | 23 | 20 | | 1 | 88 | 40-150 | 04/26/2024 1019 |
| PFDA | 24 | 25 | | 1 | 103 | 40-150 | 04/26/2024 1019 |
| PFDoS | 23 | 19 | | 1 | 83 | 40-150 | 04/26/2024 1019 |
| PFDoA | 24 | 26 | | 1 | 108 | 40-150 | 04/26/2024 1019 |
| PFHpS | 23 | 23 | | 1 | 101 | 40-150 | 04/26/2024 1019 |
| PFHpA | 24 | 24 | | 1 | 102 | 40-150 | 04/26/2024 1019 |
| 7:3FTCA | 600 | 650 | | 1 | 108 | 40-150 | 04/26/2024 1019 |
| PFHxS | 22 | 24 | M-03 | 1 | 109 | 40-150 | 04/26/2024 1019 |
| PFHxA | 24 | 25 | | 1 | 105 | 40-150 | 04/26/2024 1019 |
| PFNS | 23 | 23 | | 1 | 98 | 40-150 | 04/26/2024 1019 |
| PFNA | 24 | 25 | | 1 | 104 | 40-150 | 04/26/2024 1019 |
| PFOSA | 24 | 24 | | 1 | 102 | 40-150 | 04/26/2024 1019 |
| PFOS | 22 | 23 | M-03 | 1 | 103 | 40-150 | 04/26/2024 1019 |
| PFOA | 24 | 25 | | 1 | 103 | 40-150 | 04/26/2024 1019 |
| PFPeS | 23 | 25 | | 1 | 113 | 40-150 | 04/26/2024 1019 |
| PFPeA | 48 | 52 | | 1 | 109 | 40-150 | 04/26/2024 1019 |
| 3:3FTCA | 120 | 130 | | 1 | 110 | 40-150 | 04/26/2024 1019 |
| PFTeDA | 24 | 25 | | 1 | 103 | 40-150 | 04/26/2024 1019 |
| PFTrDA | 24 | 24 | | 1 | 101 | 40-150 | 04/26/2024 1019 |
| PFUnA | 24 | 27 | | 1 | 113 | 40-150 | 04/26/2024 1019 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 87 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10632-002
Batch: 10632
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 1714

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 84 | 20-150 |
| 13C2-PFDoA | | 69 | 20-150 |
| 13C2-PFTeDA | | 65 | 20-150 |
| 13C3-HFPO-DA | | 83 | 20-150 |
| 13C3-PFBS | | 83 | 20-150 |
| 13C3-PFHxS | | 82 | 20-150 |
| 13C4-PFBA | | 83 | 20-150 |
| 13C4-PFHpA | | 88 | 20-150 |
| 13C5-PFHxA | | 85 | 20-150 |
| 13C5-PFPeA | | 86 | 20-150 |
| 13C6-PFDA | | 81 | 20-150 |
| 13C7-PFUnA | | 70 | 20-150 |
| 13C8-PFOA | | 86 | 20-150 |
| 13C8-PFOS | | 86 | 20-150 |
| 13C8-PFOSA | | 81 | 20-150 |
| 13C9-PFNA | | 89 | 20-150 |
| D3-NMeFOSA | | 61 | 20-150 |
| D3-NMeFOSAA | | 84 | 20-150 |
| D5-NEtFOSA | | 65 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 |
| D7-NMeFOSE | | 74 | 20-150 |
| D9-NEtFOSE | | 74 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10632-102
Batch: 10632
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 1714

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.8 | | 1 | 103 | 40-150 | 04/26/2024 1028 |
| 9Cl-PF3ONS | 7.5 | 8.4 | | 1 | 113 | 40-150 | 04/26/2024 1028 |
| ADONA | 7.6 | 9.4 | | 1 | 125 | 40-150 | 04/26/2024 1028 |
| 8:2FTS | 7.7 | 9.2 | M-03 | 1 | 120 | 40-150 | 04/26/2024 1028 |
| 4:2FTS | 7.5 | 8.4 | | 1 | 112 | 40-150 | 04/26/2024 1028 |
| 6:2FTS | 7.6 | 8.7 | M-03 | 1 | 114 | 40-150 | 04/26/2024 1028 |
| 5:3FTCA | 50 | 54 | | 1 | 108 | 40-150 | 04/26/2024 1028 |
| HFPO-DA | 8.0 | 8.4 | | 1 | 105 | 40-150 | 04/26/2024 1028 |
| NEtFOSA | 2.0 | 2.1 | | 1 | 104 | 40-150 | 04/26/2024 1028 |
| NEtFOSAA | 2.0 | 2.3 | M-03 | 1 | 116 | 40-150 | 04/26/2024 1028 |
| NEtFOSE | 20 | 21 | | 1 | 107 | 40-150 | 04/26/2024 1028 |
| NMeFOSA | 2.0 | 2.0 | | 1 | 101 | 40-150 | 04/26/2024 1028 |
| NMeFOSAA | 2.0 | 2.0 | M-03 | 1 | 101 | 40-150 | 04/26/2024 1028 |
| NMeFOSE | 20 | 21 | | 1 | 106 | 40-150 | 04/26/2024 1028 |
| NFDHA | 4.0 | 3.8 | | 1 | 95 | 40-150 | 04/26/2024 1028 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.0 | M-03 | 1 | 111 | 40-150 | 04/26/2024 1028 |
| PFMPA | 4.0 | 4.3 | | 1 | 109 | 40-150 | 04/26/2024 1028 |
| PFMBA | 4.0 | 4.0 | | 1 | 100 | 40-150 | 04/26/2024 1028 |
| PFBS | 1.8 | 2.1 | | 1 | 118 | 40-150 | 04/26/2024 1028 |
| PFBA | 8.0 | 9.0 | | 1 | 113 | 40-150 | 04/26/2024 1028 |
| PFDS | 1.9 | 2.1 | | 1 | 107 | 40-150 | 04/26/2024 1028 |
| PFDA | 2.0 | 2.3 | | 1 | 114 | 40-150 | 04/26/2024 1028 |
| PFDoS | 1.9 | 1.7 | M-03 | 1 | 88 | 40-150 | 04/26/2024 1028 |
| PFDoA | 2.0 | 2.3 | M-03 | 1 | 115 | 40-150 | 04/26/2024 1028 |
| PFHpS | 1.9 | 2.1 | | 1 | 111 | 40-150 | 04/26/2024 1028 |
| PFHpA | 2.0 | 2.1 | M-03 | 1 | 103 | 40-150 | 04/26/2024 1028 |
| 7:3FTCA | 50 | 55 | | 1 | 110 | 40-150 | 04/26/2024 1028 |
| PFHxS | 1.8 | 1.9 | | 1 | 104 | 40-150 | 04/26/2024 1028 |
| PFHxA | 2.0 | 2.1 | | 1 | 103 | 40-150 | 04/26/2024 1028 |
| PFNS | 1.9 | 1.8 | | 1 | 92 | 40-150 | 04/26/2024 1028 |
| PFNA | 2.0 | 2.3 | M-03 | 1 | 117 | 40-150 | 04/26/2024 1028 |
| PFOSA | 2.0 | 2.4 | M-03 | 1 | 119 | 40-150 | 04/26/2024 1028 |
| PFOS | 1.9 | 2.3 | M-03 | 1 | 123 | 40-150 | 04/26/2024 1028 |
| PFOA | 2.0 | 2.5 | M-03 | 1 | 124 | 40-150 | 04/26/2024 1028 |
| PFPeS | 1.9 | 2.0 | | 1 | 105 | 40-150 | 04/26/2024 1028 |
| PFPeA | 4.0 | 4.9 | | 1 | 123 | 40-150 | 04/26/2024 1028 |
| 3:3FTCA | 10 | 11 | | 1 | 105 | 40-150 | 04/26/2024 1028 |
| PFTeDA | 2.0 | 2.2 | M-03 | 1 | 109 | 40-150 | 04/26/2024 1028 |
| PFTrDA | 2.0 | 2.3 | M-03 | 1 | 117 | 40-150 | 04/26/2024 1028 |
| PFUnA | 2.0 | 2.2 | M-03 | 1 | 112 | 40-150 | 04/26/2024 1028 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 86 | 20-150 |
| 13C2-6:2FTS | | 83 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10632-102
Batch: 10632
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 1714

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | M-03 | 81 | 20-150 |
| 13C2-PFDoA | | 69 | 20-150 |
| 13C2-PFTeDA | | 65 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 |
| 13C3-PFBS | | 88 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 |
| 13C4-PFBA | | 85 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 |
| 13C5-PFPeA | | 88 | 20-150 |
| 13C6-PFDA | | 80 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 |
| 13C8-PFOA | | 84 | 20-150 |
| 13C8-PFOS | | 89 | 20-150 |
| 13C8-PFOSA | | 79 | 20-150 |
| 13C9-PFNA | | 87 | 20-150 |
| D3-NMeFOSA | | 66 | 20-150 |
| D3-NMeFOSAA | | 77 | 20-150 |
| D5-NEtFOSA | | 69 | 20-150 |
| D5-NEtFOSAA | | 81 | 20-150 |
| D7-NMeFOSE | | 80 | 20-150 |
| D9-NEtFOSE | | 77 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZD05031-027MS
Batch: 10632
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 1714

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 84 | 56 | | 1 | 67 | 40-150 | 05/02/2024 0639 |
| 9Cl-PF3ONS | ND | 83 | 87 | | 1 | 104 | 40-150 | 05/02/2024 0639 |
| ADONA | ND | 84 | 99 | | 1 | 118 | 40-150 | 05/02/2024 0639 |
| 8:2FTS | 6.4 | 86 | 88 | | 1 | 95 | 40-150 | 05/02/2024 0639 |
| 4:2FTS | ND | 84 | 87 | | 1 | 104 | 40-150 | 05/02/2024 0639 |
| 6:2FTS | 2.8 | 85 | 86 | | 1 | 99 | 40-150 | 05/02/2024 0639 |
| 5:3FTCA | ND | 560 | 550 | | 1 | 98 | 40-150 | 05/02/2024 0639 |
| HFPO-DA | ND | 89 | 110 | | 1 | 121 | 40-150 | 05/02/2024 0639 |
| NEtFOSA | ND | 22 | 20 | | 1 | 92 | 40-150 | 05/02/2024 0639 |
| NEtFOSAA | ND | 22 | 25 | M-03 | 1 | 113 | 40-150 | 05/02/2024 0639 |
| NEtFOSE | ND | 220 | 210 | | 1 | 93 | 40-150 | 05/02/2024 0639 |
| NMeFOSA | ND | 22 | 21 | | 1 | 94 | 40-150 | 05/02/2024 0639 |
| NMeFOSAA | ND | 22 | 21 | M-03 | 1 | 94 | 40-150 | 05/02/2024 0639 |
| NMeFOSE | ND | 220 | 200 | | 1 | 91 | 40-150 | 05/02/2024 0639 |
| NFDHA | ND | 45 | 52 | | 1 | 116 | 40-150 | 05/02/2024 0639 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 40 | 42 | | 1 | 107 | 40-150 | 05/02/2024 0639 |
| PFMPA | ND | 45 | 48 | | 1 | 107 | 40-150 | 05/02/2024 0639 |
| PFMBA | ND | 45 | 46 | | 1 | 103 | 40-150 | 05/02/2024 0639 |
| PFBS | 5.8 | 20 | 25 | | 1 | 97 | 40-150 | 05/02/2024 0639 |
| PFBA | 8.3 | 89 | 99 | | 1 | 102 | 40-150 | 05/02/2024 0639 |
| PFDS | ND | 21 | 16 | | 1 | 75 | 40-150 | 05/02/2024 0639 |
| PFDA | ND | 22 | 21 | | 1 | 96 | 40-150 | 05/02/2024 0639 |
| PFDoS | ND | 22 | 12 | | 1 | 55 | 40-150 | 05/02/2024 0639 |
| PFDoA | ND | 22 | 21 | | 1 | 93 | 40-150 | 05/02/2024 0639 |
| PFHpS | 13 | 21 | 34 | | 1 | 99 | 40-150 | 05/02/2024 0639 |
| PFHpA | 9.2 | 22 | 34 | | 1 | 110 | 40-150 | 05/02/2024 0639 |
| 7:3FTCA | ND | 560 | 450 | | 1 | 82 | 40-150 | 05/02/2024 0639 |
| PFHxS | 150 | 20 | 180 | | 1 | 123 | 40-150 | 05/02/2024 0639 |
| PFHxA | 14 | 22 | 38 | M-03 | 1 | 107 | 40-150 | 05/02/2024 0639 |
| PFNS | ND | 21 | 20 | | 1 | 95 | 40-150 | 05/02/2024 0639 |
| PFNA | 4.7 | 22 | 28 | | 1 | 102 | 40-150 | 05/02/2024 0639 |
| PFOSA | 1.2 | 22 | 25 | M-03 | 1 | 106 | 40-150 | 05/02/2024 0639 |
| PFOS | 770 | 21 | 830 | NM-03 | 1 | 272 | 40-150 | 05/02/2024 0639 |
| PFOA | 27 | 22 | 48 | M-03 | 1 | 93 | 40-150 | 05/02/2024 0639 |
| PFPeS | 9.5 | 21 | 31 | | 1 | 101 | 40-150 | 05/02/2024 0639 |
| PFPeA | 10 | 45 | 56 | | 1 | 104 | 40-150 | 05/02/2024 0639 |
| 3:3FTCA | ND | 110 | 110 | | 1 | 97 | 40-150 | 05/02/2024 0639 |
| PFTeDA | ND | 22 | 23 | | 1 | 104 | 40-150 | 05/02/2024 0639 |
| PFTrDA | ND | 22 | 17 | | 1 | 75 | 40-150 | 05/02/2024 0639 |
| PFUnA | ND | 22 | 22 | | 1 | 100 | 40-150 | 05/02/2024 0639 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 93 | 20-150 |
| 13C2-6:2FTS | | 86 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZD05031-027MS
Batch: 10632
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 1714

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 83 | 20-150 |
| 13C2-PFDoA | | 55 | 20-150 |
| 13C2-PFTeDA | | 34 | 20-150 |
| 13C3-HFPO-DA | | 83 | 20-150 |
| 13C3-PFBS | | 91 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 |
| 13C4-PFHpA | | 80 | 20-150 |
| 13C5-PFHxA | | 87 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 |
| 13C7-PFUnA | | 64 | 20-150 |
| 13C8-PFOA | | 78 | 20-150 |
| 13C8-PFOS | | 79 | 20-150 |
| 13C8-PFOSA | | 73 | 20-150 |
| 13C9-PFNA | | 79 | 20-150 |
| D3-NMeFOSA | | 59 | 20-150 |
| D3-NMeFOSAA | | 67 | 20-150 |
| D5-NEtFOSA | | 58 | 20-150 |
| D5-NEtFOSAA | | 57 | 20-150 |
| D7-NMeFOSE | | 70 | 20-150 |
| D9-NEtFOSE | | 65 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: ZD05031-027MD
Batch: 10632
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 1714

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 86 | 52 | | 1 | 60 | 8.4 | 40-150 | 30 | 05/02/2024 0648 |
| 9Cl-PF3ONS | ND | 86 | 82 | | 1 | 96 | 6.0 | 40-150 | 30 | 05/02/2024 0648 |
| ADONA | ND | 86 | 100 | | 1 | 115 | 0.42 | 40-150 | 30 | 05/02/2024 0648 |
| 8:2FTS | 6.4 | 88 | 97 | | 1 | 103 | 10 | 40-150 | 30 | 05/02/2024 0648 |
| 4:2FTS | ND | 86 | 85 | | 1 | 99 | 2.1 | 40-150 | 30 | 05/02/2024 0648 |
| 6:2FTS | 2.8 | 87 | 90 | | 1 | 100 | 3.7 | 40-150 | 30 | 05/02/2024 0648 |
| 5:3FTCA | ND | 570 | 570 | | 1 | 99 | 3.2 | 40-150 | 30 | 05/02/2024 0648 |
| HFPO-DA | ND | 92 | 110 | | 1 | 117 | 0.70 | 40-150 | 30 | 05/02/2024 0648 |
| NEtFOSA | ND | 23 | 21 | | 1 | 91 | 2.0 | 40-150 | 30 | 05/02/2024 0648 |
| NEtFOSAA | ND | 23 | 25 | M-03 | 1 | 109 | 0.70 | 40-150 | 30 | 05/02/2024 0648 |
| NEtFOSE | ND | 230 | 220 | | 1 | 96 | 6.2 | 40-150 | 30 | 05/02/2024 0648 |
| NMeFOSA | ND | 23 | 20 | | 1 | 88 | 4.2 | 40-150 | 30 | 05/02/2024 0648 |
| NMeFOSAA | ND | 23 | 24 | M-03 | 1 | 103 | 12 | 40-150 | 30 | 05/02/2024 0648 |
| NMeFOSE | ND | 230 | 220 | | 1 | 95 | 6.8 | 40-150 | 30 | 05/02/2024 0648 |
| NFDHA | ND | 46 | 47 | | 1 | 104 | 9.0 | 40-150 | 30 | 05/02/2024 0648 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 41 | 42 | | 1 | 104 | 0.28 | 40-150 | 30 | 05/02/2024 0648 |
| PFMPA | ND | 46 | 51 | | 1 | 112 | 7.6 | 40-150 | 30 | 05/02/2024 0648 |
| PFMBA | ND | 46 | 48 | | 1 | 105 | 4.3 | 40-150 | 30 | 05/02/2024 0648 |
| PFBS | 5.8 | 20 | 26 | | 1 | 98 | 2.7 | 40-150 | 30 | 05/02/2024 0648 |
| PFBA | 8.3 | 92 | 100 | | 1 | 103 | 3.3 | 40-150 | 30 | 05/02/2024 0648 |
| PFDS | ND | 22 | 14 | | 1 | 63 | 15 | 40-150 | 30 | 05/02/2024 0648 |
| PFDA | ND | 23 | 24 | | 1 | 103 | 9.5 | 40-150 | 30 | 05/02/2024 0648 |
| PFDoS | ND | 22 | 9.6 | | 1 | 43 | 21 | 40-150 | 30 | 05/02/2024 0648 |
| PFDoA | ND | 23 | 23 | | 1 | 101 | 11 | 40-150 | 30 | 05/02/2024 0648 |
| PFHpS | 13 | 22 | 36 | | 1 | 107 | 6.6 | 40-150 | 30 | 05/02/2024 0648 |
| PFHpA | 9.2 | 23 | 34 | | 1 | 109 | 1.5 | 40-150 | 30 | 05/02/2024 0648 |
| 7:3FTCA | ND | 570 | 430 | | 1 | 74 | 6.4 | 40-150 | 30 | 05/02/2024 0648 |
| PFHxS | 150 | 21 | 170 | M-03 | 1 | 115 | 0.59 | 40-150 | 30 | 05/02/2024 0648 |
| PFHxA | 14 | 23 | 36 | | 1 | 95 | 6.1 | 40-150 | 30 | 05/02/2024 0648 |
| PFNS | ND | 22 | 19 | | 1 | 87 | 6.3 | 40-150 | 30 | 05/02/2024 0648 |
| PFNA | 4.7 | 23 | 26 | | 1 | 94 | 4.6 | 40-150 | 30 | 05/02/2024 0648 |
| PFOSA | 1.2 | 23 | 25 | M-03 | 1 | 105 | 1.6 | 40-150 | 30 | 05/02/2024 0648 |
| PFOS | 770 | 21 | 810 | EM-03 | 1 | 149 | 3.0 | 40-150 | 30 | 05/02/2024 0648 |
| PFOA | 27 | 23 | 50 | M-03 | 1 | 101 | 4.6 | 40-150 | 30 | 05/02/2024 0648 |
| PFPeS | 9.5 | 22 | 29 | | 1 | 90 | 6.0 | 40-150 | 30 | 05/02/2024 0648 |
| PFPeA | 10 | 46 | 56 | M-03 | 1 | 100 | 0.80 | 40-150 | 30 | 05/02/2024 0648 |
| 3:3FTCA | ND | 110 | 120 | | 1 | 103 | 8.5 | 40-150 | 30 | 05/02/2024 0648 |
| PFTeDA | ND | 23 | 23 | | 1 | 101 | 0.69 | 40-150 | 30 | 05/02/2024 0648 |
| PFTrDA | ND | 23 | 17 | | 1 | 76 | 3.6 | 40-150 | 30 | 05/02/2024 0648 |
| PFUnA | ND | 23 | 22 | | 1 | 97 | 0.65 | 40-150 | 30 | 05/02/2024 0648 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 97 | 20-150 |
| 13C2-6:2FTS | | 89 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: ZD05031-027MD
Batch: 10632
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 1714

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 83 | 20-150 |
| 13C2-PFDoA | | 50 | 20-150 |
| 13C2-PFTeDA | | 36 | 20-150 |
| 13C3-HFPO-DA | | 86 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 |
| 13C3-PFHxS | | 100 | 20-150 |
| 13C4-PFBA | | 90 | 20-150 |
| 13C4-PFHpA | | 83 | 20-150 |
| 13C5-PFHxA | | 93 | 20-150 |
| 13C5-PFPeA | | 93 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 |
| 13C7-PFUnA | | 63 | 20-150 |
| 13C8-PFOA | | 79 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 |
| 13C8-PFOSA | | 71 | 20-150 |
| 13C9-PFNA | | 88 | 20-150 |
| D3-NMeFOSA | | 61 | 20-150 |
| D3-NMeFOSAA | | 57 | 20-150 |
| D5-NEtFOSA | | 55 | 20-150 |
| D5-NEtFOSAA | | 55 | 20-150 |
| D7-NMeFOSE | | 64 | 20-150 |
| D9-NEtFOSE | | 56 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ10637-001
Batch: 10637
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 0811

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 04/26/2024 1725 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 04/26/2024 1725 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 04/26/2024 1725 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 04/26/2024 1725 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 04/26/2024 1725 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 04/26/2024 1725 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 04/26/2024 1725 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 04/26/2024 1725 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 04/26/2024 1725 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 04/26/2024 1725 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 04/26/2024 1725 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 04/26/2024 1725 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 04/26/2024 1725 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 04/26/2024 1725 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 04/26/2024 1725 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 04/26/2024 1725 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 04/26/2024 1725 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 04/26/2024 1725 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 04/26/2024 1725 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 04/26/2024 1725 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 04/26/2024 1725 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 04/26/2024 1725 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 04/26/2024 1725 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 04/26/2024 1725 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 04/26/2024 1725 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 04/26/2024 1725 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 04/26/2024 1725 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 04/26/2024 1725 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 04/26/2024 1725 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 04/26/2024 1725 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 04/26/2024 1725 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 04/26/2024 1725 |
| PFOS | 0.29 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 04/26/2024 1725 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 04/26/2024 1725 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 04/26/2024 1725 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 04/26/2024 1725 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 04/26/2024 1725 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 04/26/2024 1725 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 04/26/2024 1725 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 04/26/2024 1725 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 92 | 20-150 |
| 13C2-6:2FTS | | 94 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ10637-001
Batch: 10637
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 0811

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 100 | 20-150 |
| 13C2-PFDoA | | 87 | 20-150 |
| 13C2-PFTeDA | | 87 | 20-150 |
| 13C3-HFPO-DA | | 92 | 20-150 |
| 13C3-PFBS | | 101 | 20-150 |
| 13C3-PFHxS | | 107 | 20-150 |
| 13C4-PFBA | | 75 | 20-150 |
| 13C4-PFHpA | | 95 | 20-150 |
| 13C5-PFHxA | | 98 | 20-150 |
| 13C5-PFPeA | | 98 | 20-150 |
| 13C6-PFDA | | 96 | 20-150 |
| 13C7-PFUnA | | 91 | 20-150 |
| 13C8-PFOA | | 93 | 20-150 |
| 13C8-PFOS | | 104 | 20-150 |
| 13C8-PFOSA | | 91 | 20-150 |
| 13C9-PFNA | M-03 | 108 | 20-150 |
| D3-NMeFOSA | | 69 | 20-150 |
| D3-NMeFOSAA | | 92 | 20-150 |
| D5-NEtFOSA | | 67 | 20-150 |
| D5-NEtFOSAA | | 100 | 20-150 |
| D7-NMeFOSE | | 87 | 20-150 |
| D9-NEtFOSE | | 84 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10637-002
Batch: 10637
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 0811

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 100 | | 1 | 111 | 40-150 | 04/26/2024 1734 |
| 9Cl-PF3ONS | 90 | 110 | | 1 | 123 | 40-150 | 04/26/2024 1734 |
| ADONA | 91 | 120 | | 1 | 128 | 40-150 | 04/26/2024 1734 |
| 8:2FTS | 92 | 93 | | 1 | 101 | 40-150 | 04/26/2024 1734 |
| 4:2FTS | 90 | 99 | | 1 | 110 | 40-150 | 04/26/2024 1734 |
| 6:2FTS | 91 | 94 | M-03 | 1 | 103 | 40-150 | 04/26/2024 1734 |
| 5:3FTCA | 600 | 630 | | 1 | 104 | 40-150 | 04/26/2024 1734 |
| HFPO-DA | 96 | 110 | | 1 | 118 | 40-150 | 04/26/2024 1734 |
| NEtFOSA | 24 | 23 | | 1 | 96 | 40-150 | 04/26/2024 1734 |
| NEtFOSAA | 24 | 26 | M-03 | 1 | 107 | 40-150 | 04/26/2024 1734 |
| NEtFOSE | 240 | 250 | | 1 | 104 | 40-150 | 04/26/2024 1734 |
| NMeFOSA | 24 | 25 | | 1 | 104 | 40-150 | 04/26/2024 1734 |
| NMeFOSAA | 24 | 27 | | 1 | 114 | 40-150 | 04/26/2024 1734 |
| NMeFOSE | 240 | 250 | | 1 | 105 | 40-150 | 04/26/2024 1734 |
| NFDHA | 48 | 53 | M-03 | 1 | 110 | 40-150 | 04/26/2024 1734 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 49 | | 1 | 115 | 40-150 | 04/26/2024 1734 |
| PFMPA | 48 | 55 | | 1 | 114 | 40-150 | 04/26/2024 1734 |
| PFMBA | 48 | 54 | | 1 | 112 | 40-150 | 04/26/2024 1734 |
| PFBS | 21 | 23 | | 1 | 106 | 40-150 | 04/26/2024 1734 |
| PFBA | 96 | 100 | | 1 | 109 | 40-150 | 04/26/2024 1734 |
| PFDS | 23 | 23 | | 1 | 99 | 40-150 | 04/26/2024 1734 |
| PFDA | 24 | 27 | | 1 | 114 | 40-150 | 04/26/2024 1734 |
| PFDoS | 23 | 22 | | 1 | 96 | 40-150 | 04/26/2024 1734 |
| PFDoA | 24 | 28 | | 1 | 117 | 40-150 | 04/26/2024 1734 |
| PFHpS | 23 | 27 | | 1 | 116 | 40-150 | 04/26/2024 1734 |
| PFHpA | 24 | 27 | | 1 | 113 | 40-150 | 04/26/2024 1734 |
| 7:3FTCA | 600 | 610 | | 1 | 102 | 40-150 | 04/26/2024 1734 |
| PFHxS | 22 | 23 | | 1 | 105 | 40-150 | 04/26/2024 1734 |
| PFHxA | 24 | 26 | M-03 | 1 | 110 | 40-150 | 04/26/2024 1734 |
| PFNS | 23 | 25 | | 1 | 109 | 40-150 | 04/26/2024 1734 |
| PFNA | 24 | 29 | | 1 | 121 | 40-150 | 04/26/2024 1734 |
| PFOSA | 24 | 27 | | 1 | 111 | 40-150 | 04/26/2024 1734 |
| PFOS | 22 | 24 | M-03 | 1 | 109 | 40-150 | 04/26/2024 1734 |
| PFOA | 24 | 27 | | 1 | 111 | 40-150 | 04/26/2024 1734 |
| PFPeS | 23 | 24 | | 1 | 106 | 40-150 | 04/26/2024 1734 |
| PFPeA | 48 | 52 | | 1 | 109 | 40-150 | 04/26/2024 1734 |
| 3:3FTCA | 120 | 130 | | 1 | 110 | 40-150 | 04/26/2024 1734 |
| PFTeDA | 24 | 26 | | 1 | 110 | 40-150 | 04/26/2024 1734 |
| PFTrDA | 24 | 26 | | 1 | 110 | 40-150 | 04/26/2024 1734 |
| PFUnA | 24 | 26 | | 1 | 107 | 40-150 | 04/26/2024 1734 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 77 | 20-150 |
| 13C2-6:2FTS | | 75 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10637-002
Batch: 10637
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 0811

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 82 | 20-150 |
| 13C2-PFDoA | | 73 | 20-150 |
| 13C2-PFTeDA | | 77 | 20-150 |
| 13C3-HFPO-DA | | 78 | 20-150 |
| 13C3-PFBS | | 81 | 20-150 |
| 13C3-PFHxS | | 82 | 20-150 |
| 13C4-PFBA | | 81 | 20-150 |
| 13C4-PFHpA | | 77 | 20-150 |
| 13C5-PFHxA | | 82 | 20-150 |
| 13C5-PFPeA | | 81 | 20-150 |
| 13C6-PFDA | | 75 | 20-150 |
| 13C7-PFUnA | | 77 | 20-150 |
| 13C8-PFOA | | 73 | 20-150 |
| 13C8-PFOS | | 76 | 20-150 |
| 13C8-PFOSA | | 72 | 20-150 |
| 13C9-PFNA | | 81 | 20-150 |
| D3-NMeFOSA | | 53 | 20-150 |
| D3-NMeFOSAA | | 71 | 20-150 |
| D5-NEtFOSA | | 57 | 20-150 |
| D5-NEtFOSAA | | 76 | 20-150 |
| D7-NMeFOSE | | 69 | 20-150 |
| D9-NEtFOSE | | 70 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10637-102
Batch: 10637
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 0811

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 8.0 | M-03 | 1 | 106 | 40-150 | 04/26/2024 1743 |
| 9Cl-PF3ONS | 7.5 | 8.4 | | 1 | 112 | 40-150 | 04/26/2024 1743 |
| ADONA | 7.6 | 8.4 | | 1 | 111 | 40-150 | 04/26/2024 1743 |
| 8:2FTS | 7.7 | 8.9 | | 1 | 116 | 40-150 | 04/26/2024 1743 |
| 4:2FTS | 7.5 | 7.6 | | 1 | 102 | 40-150 | 04/26/2024 1743 |
| 6:2FTS | 7.6 | 8.1 | | 1 | 107 | 40-150 | 04/26/2024 1743 |
| 5:3FTCA | 50 | 50 | | 1 | 100 | 40-150 | 04/26/2024 1743 |
| HFPO-DA | 8.0 | 8.6 | M-03 | 1 | 107 | 40-150 | 04/26/2024 1743 |
| NEtFOSA | 2.0 | 2.1 | M-03 | 1 | 104 | 40-150 | 04/26/2024 1743 |
| NEtFOSAA | 2.0 | 1.9 | M-03 | 1 | 93 | 40-150 | 04/26/2024 1743 |
| NEtFOSE | 20 | 20 | | 1 | 98 | 40-150 | 04/26/2024 1743 |
| NMeFOSA | 2.0 | 2.0 | M-03 | 1 | 98 | 40-150 | 04/26/2024 1743 |
| NMeFOSAA | 2.0 | 2.1 | M-03 | 1 | 106 | 40-150 | 04/26/2024 1743 |
| NMeFOSE | 20 | 20 | | 1 | 100 | 40-150 | 04/26/2024 1743 |
| NFDHA | 4.0 | 3.6 | | 1 | 90 | 40-150 | 04/26/2024 1743 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.7 | | 1 | 105 | 40-150 | 04/26/2024 1743 |
| PFMPA | 4.0 | 4.4 | | 1 | 111 | 40-150 | 04/26/2024 1743 |
| PFMBA | 4.0 | 4.1 | | 1 | 102 | 40-150 | 04/26/2024 1743 |
| PFBS | 1.8 | 1.9 | M-03 | 1 | 105 | 40-150 | 04/26/2024 1743 |
| PFBA | 8.0 | 8.4 | | 1 | 105 | 40-150 | 04/26/2024 1743 |
| PFDS | 1.9 | 2.1 | M-03 | 1 | 107 | 40-150 | 04/26/2024 1743 |
| PFDA | 2.0 | 2.0 | | 1 | 101 | 40-150 | 04/26/2024 1743 |
| PFDoS | 1.9 | 1.9 | M-03 | 1 | 100 | 40-150 | 04/26/2024 1743 |
| PFDoA | 2.0 | 2.1 | M-03 | 1 | 104 | 40-150 | 04/26/2024 1743 |
| PFHpS | 1.9 | 2.1 | M-03 | 1 | 110 | 40-150 | 04/26/2024 1743 |
| PFHpA | 2.0 | 2.0 | | 1 | 98 | 40-150 | 04/26/2024 1743 |
| 7:3FTCA | 50 | 48 | | 1 | 97 | 40-150 | 04/26/2024 1743 |
| PFHxS | 1.8 | 2.2 | M-03 | 1 | 122 | 40-150 | 04/26/2024 1743 |
| PFHxA | 2.0 | 2.0 | M-03 | 1 | 100 | 40-150 | 04/26/2024 1743 |
| PFNS | 1.9 | 2.1 | M-03 | 1 | 110 | 40-150 | 04/26/2024 1743 |
| PFNA | 2.0 | 2.4 | | 1 | 120 | 40-150 | 04/26/2024 1743 |
| PFOSA | 2.0 | 2.1 | M-03 | 1 | 105 | 40-150 | 04/26/2024 1743 |
| PFOS | 1.9 | 7.7 | NM-03 | 1 | 417 | 40-150 | 04/26/2024 1743 |
| PFOA | 2.0 | 2.2 | | 1 | 112 | 40-150 | 04/26/2024 1743 |
| PFPeS | 1.9 | 1.8 | M-03 | 1 | 96 | 40-150 | 04/26/2024 1743 |
| PFPeA | 4.0 | 4.5 | | 1 | 112 | 40-150 | 04/26/2024 1743 |
| 3:3FTCA | 10 | 9.5 | M-03 | 1 | 95 | 40-150 | 04/26/2024 1743 |
| PFTeDA | 2.0 | 2.2 | M-03 | 1 | 109 | 40-150 | 04/26/2024 1743 |
| PFTrDA | 2.0 | 2.0 | M-03 | 1 | 102 | 40-150 | 04/26/2024 1743 |
| PFUnA | 2.0 | 1.8 | | 1 | 89 | 40-150 | 04/26/2024 1743 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 84 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10637-102
Batch: 10637
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 0811

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 77 | 20-150 |
| 13C2-PFDoA | | 80 | 20-150 |
| 13C2-PFTeDA | | 73 | 20-150 |
| 13C3-HFPO-DA | | 83 | 20-150 |
| 13C3-PFBS | | 82 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 |
| 13C4-PFBA | | 87 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 |
| 13C5-PFHxA | | 88 | 20-150 |
| 13C5-PFPeA | | 87 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 |
| 13C7-PFUnA | | 84 | 20-150 |
| 13C8-PFOA | | 87 | 20-150 |
| 13C8-PFOS | | 88 | 20-150 |
| 13C8-PFOSA | | 81 | 20-150 |
| 13C9-PFNA | | 92 | 20-150 |
| D3-NMeFOSA | | 54 | 20-150 |
| D3-NMeFOSAA | | 83 | 20-150 |
| D5-NEtFOSA | | 55 | 20-150 |
| D5-NEtFOSAA | | 85 | 20-150 |
| D7-NMeFOSE | | 76 | 20-150 |
| D9-NEtFOSE | | 77 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: ZD05031-012DU
Batch: 10637
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 0811

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| 9Cl-PF3ONS | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| ADONA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| 8:2FTS | 59 | 61 | | 1 | 3.1 | 20 | 04/26/2024 1907 |
| 4:2FTS | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| 6:2FTS | 140 | 130 | M-03 | 1 | 7.3 | 20 | 04/26/2024 1907 |
| 5:3FTCA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| HFPO-DA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| NEtFOSA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| NEtFOSAA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| NEtFOSE | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| NMeFOSA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| NMeFOSAA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| NMeFOSE | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| NFDHA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFMPA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFMBA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFBS | 25 | 27 | M-03 | 1 | 9.1 | 20 | 04/26/2024 1907 |
| PFBA | 54 | 55 | | 1 | 0.93 | 20 | 04/26/2024 1907 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFDA | 0.32 | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFDoS | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFHpS | 270 | 290 | | 1 | 7.7 | 20 | 04/26/2024 1907 |
| PFHpA | 150 | 160 | | 1 | 2.0 | 20 | 04/26/2024 1907 |
| 7:3FTCA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFHxS | 2500 | 2600 | E | 1 | 5.4 | 20 | 04/26/2024 1907 |
| PFHxA | 230 | 250 | M-03 | 1 | 7.9 | 20 | 04/26/2024 1907 |
| PFNS | 1.4 | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFNA | 96 | 99 | M-03 | 1 | 2.4 | 20 | 04/26/2024 1907 |
| PFOSA | 4.7 | 4.5 | M-03 | 1 | 3.0 | 20 | 04/26/2024 1907 |
| PFOS | 28000 | 29000 | EM-03 | 1 | 4.3 | 20 | 04/26/2024 1907 |
| PFOA | 300 | 310 | | 1 | 1.3 | 20 | 04/26/2024 1907 |
| PFPeS | 71 | 74 | | 1 | 4.8 | 20 | 04/26/2024 1907 |
| PFPeA | 130 | 130 | | 1 | 2.5 | 20 | 04/26/2024 1907 |
| 3:3FTCA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |
| PFUnA | ND | ND | | 1 | 0.00 | 20 | 04/26/2024 1907 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 101 | 20-150 |
| 13C2-6:2FTS | | 98 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: ZD05031-012DU
Batch: 10637
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 0811

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 92 | 20-150 |
| 13C2-PFDoA | | 83 | 20-150 |
| 13C2-PFTeDA | | 63 | 20-150 |
| 13C3-HFPO-DA | | 82 | 20-150 |
| 13C3-PFBS | | 97 | 20-150 |
| 13C3-PFHxS | | 84 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 |
| 13C4-PFHpA | | 84 | 20-150 |
| 13C5-PFHxA | | 86 | 20-150 |
| 13C5-PFPeA | | 89 | 20-150 |
| 13C6-PFDA | | 92 | 20-150 |
| 13C7-PFUnA | M-03 | 90 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 |
| 13C8-PFOS | M-03 | 87 | 20-150 |
| 13C8-PFOSA | | 132 | 20-150 |
| 13C9-PFNA | | 91 | 20-150 |
| D3-NMeFOSA | | 111 | 20-150 |
| D3-NMeFOSAA | | 134 | 20-150 |
| D5-NEtFOSA | | 115 | 20-150 |
| D5-NEtFOSAA | | 111 | 20-150 |
| D7-NMeFOSE | | 119 | 20-150 |
| D9-NEtFOSE | | 110 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZD05031-017MS
Batch: 10637
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 0811

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 85 | 80 | | 1 | 95 | 40-150 | 04/26/2024 2002 |
| 9Cl-PF3ONS | ND | 84 | 100 | | 1 | 121 | 40-150 | 04/26/2024 2002 |
| ADONA | ND | 85 | 110 | | 1 | 126 | 40-150 | 04/26/2024 2002 |
| 8:2FTS | ND | 86 | 100 | | 1 | 117 | 40-150 | 04/26/2024 2002 |
| 4:2FTS | ND | 84 | 91 | | 1 | 108 | 40-150 | 04/26/2024 2002 |
| 6:2FTS | ND | 85 | 87 | | 1 | 102 | 40-150 | 04/26/2024 2002 |
| 5:3FTCA | ND | 560 | 670 | | 1 | 119 | 40-150 | 04/26/2024 2002 |
| HFPO-DA | ND | 90 | 110 | | 1 | 120 | 40-150 | 04/26/2024 2002 |
| NEtFOSA | ND | 22 | 23 | | 1 | 102 | 40-150 | 04/26/2024 2002 |
| NEtFOSAA | ND | 22 | 25 | | 1 | 109 | 40-150 | 04/26/2024 2002 |
| NEtFOSE | ND | 220 | 230 | | 1 | 104 | 40-150 | 04/26/2024 2002 |
| NMeFOSA | ND | 22 | 22 | | 1 | 98 | 40-150 | 04/26/2024 2002 |
| NMeFOSAA | ND | 22 | 25 | M-03 | 1 | 109 | 40-150 | 04/26/2024 2002 |
| NMeFOSE | ND | 220 | 240 | | 1 | 105 | 40-150 | 04/26/2024 2002 |
| NFDHA | ND | 45 | 54 | | 1 | 121 | 40-150 | 04/26/2024 2002 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 40 | 49 | | 1 | 123 | 40-150 | 04/26/2024 2002 |
| PFMPA | ND | 45 | 55 | | 1 | 122 | 40-150 | 04/26/2024 2002 |
| PFMBA | ND | 45 | 53 | | 1 | 118 | 40-150 | 04/26/2024 2002 |
| PFBS | 1.1 | 20 | 23 | | 1 | 108 | 40-150 | 04/26/2024 2002 |
| PFBA | 5.8 | 90 | 100 | | 1 | 109 | 40-150 | 04/26/2024 2002 |
| PFDS | ND | 22 | 20 | | 1 | 93 | 40-150 | 04/26/2024 2002 |
| PFDA | ND | 22 | 25 | | 1 | 113 | 40-150 | 04/26/2024 2002 |
| PFDoS | ND | 22 | 18 | | 1 | 82 | 40-150 | 04/26/2024 2002 |
| PFDoA | ND | 22 | 24 | | 1 | 108 | 40-150 | 04/26/2024 2002 |
| PFHpS | 1.7 | 21 | 25 | | 1 | 107 | 40-150 | 04/26/2024 2002 |
| PFHpA | 3.7 | 22 | 29 | | 1 | 111 | 40-150 | 04/26/2024 2002 |
| 7:3FTCA | ND | 560 | 650 | | 1 | 115 | 40-150 | 04/26/2024 2002 |
| PFHxS | 46 | 21 | 67 | | 1 | 104 | 40-150 | 04/26/2024 2002 |
| PFHxA | 8.1 | 22 | 35 | M-03 | 1 | 120 | 40-150 | 04/26/2024 2002 |
| PFNS | ND | 22 | 22 | | 1 | 102 | 40-150 | 04/26/2024 2002 |
| PFNA | 0.61 | 22 | 27 | M-03 | 1 | 119 | 40-150 | 04/26/2024 2002 |
| PFOSA | ND | 22 | 26 | | 1 | 115 | 40-150 | 04/26/2024 2002 |
| PFOS | 140 | 21 | 160 | M-03 | 1 | 77 | 40-150 | 04/26/2024 2002 |
| PFOA | 3.9 | 22 | 30 | M-03 | 1 | 115 | 40-150 | 04/26/2024 2002 |
| PFPeS | 1.4 | 21 | 25 | | 1 | 111 | 40-150 | 04/26/2024 2002 |
| PFPeA | 8.6 | 45 | 58 | | 1 | 109 | 40-150 | 04/26/2024 2002 |
| 3:3FTCA | ND | 110 | 120 | | 1 | 106 | 40-150 | 04/26/2024 2002 |
| PFTeDA | ND | 22 | 25 | | 1 | 113 | 40-150 | 04/26/2024 2002 |
| PFTrDA | ND | 22 | 21 | | 1 | 96 | 40-150 | 04/26/2024 2002 |
| PFUnA | ND | 22 | 24 | | 1 | 107 | 40-150 | 04/26/2024 2002 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 79 | 20-150 |
| 13C2-6:2FTS | | 79 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZD05031-017MS
Batch: 10637
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 04/25/2024 0811

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 74 | 20-150 |
| 13C2-PFDoA | | 73 | 20-150 |
| 13C2-PFTeDA | | 57 | 20-150 |
| 13C3-HFPO-DA | | 84 | 20-150 |
| 13C3-PFBS | | 79 | 20-150 |
| 13C3-PFHxS | | 80 | 20-150 |
| 13C4-PFBA | | 86 | 20-150 |
| 13C4-PFHpA | | 79 | 20-150 |
| 13C5-PFHxA | | 83 | 20-150 |
| 13C5-PFPeA | | 85 | 20-150 |
| 13C6-PFDA | | 79 | 20-150 |
| 13C7-PFUnA | | 79 | 20-150 |
| 13C8-PFOA | | 82 | 20-150 |
| 13C8-PFOS | | 82 | 20-150 |
| 13C8-PFOSA | | 69 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 |
| D3-NMeFOSA | | 62 | 20-150 |
| D3-NMeFOSAA | | 81 | 20-150 |
| D5-NEtFOSA | | 61 | 20-150 |
| D5-NEtFOSAA | | 77 | 20-150 |
| D7-NMeFOSE | | 67 | 20-150 |
| D9-NEtFOSE | | 65 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ10916-001
Batch: 10916
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/01/2024 1538

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 05/04/2024 1150 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 05/04/2024 1150 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 05/04/2024 1150 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 05/04/2024 1150 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 05/04/2024 1150 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 05/04/2024 1150 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 05/04/2024 1150 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 05/04/2024 1150 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 05/04/2024 1150 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 05/04/2024 1150 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 05/04/2024 1150 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 05/04/2024 1150 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 05/04/2024 1150 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 05/04/2024 1150 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 05/04/2024 1150 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 05/04/2024 1150 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 05/04/2024 1150 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 05/04/2024 1150 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 05/04/2024 1150 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 05/04/2024 1150 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 05/04/2024 1150 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 05/04/2024 1150 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 05/04/2024 1150 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 05/04/2024 1150 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 05/04/2024 1150 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 05/04/2024 1150 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 05/04/2024 1150 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 05/04/2024 1150 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 05/04/2024 1150 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 05/04/2024 1150 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 05/04/2024 1150 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 05/04/2024 1150 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 05/04/2024 1150 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 05/04/2024 1150 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 05/04/2024 1150 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 05/04/2024 1150 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 05/04/2024 1150 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 05/04/2024 1150 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 05/04/2024 1150 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 05/04/2024 1150 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 89 | 20-150 |
| 13C2-6:2FTS | | 88 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MB

Sample ID: ZQ10916-001
Batch: 10916
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/01/2024 1538

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 82 | 20-150 |
| 13C2-PFDoA | | 71 | 20-150 |
| 13C2-PFTeDA | | 68 | 20-150 |
| 13C3-HFPO-DA | | 94 | 20-150 |
| 13C3-PFBS | | 87 | 20-150 |
| 13C3-PFHxS | | 83 | 20-150 |
| 13C4-PFBA | | 92 | 20-150 |
| 13C4-PFHpA | | 89 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 |
| 13C5-PFPeA | | 93 | 20-150 |
| 13C6-PFDA | | 77 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 |
| 13C8-PFOA | | 93 | 20-150 |
| 13C8-PFOS | | 80 | 20-150 |
| 13C8-PFOSA | | 79 | 20-150 |
| 13C9-PFNA | | 87 | 20-150 |
| D3-NMeFOSA | | 56 | 20-150 |
| D3-NMeFOSAA | | 79 | 20-150 |
| D5-NEtFOSA | | 54 | 20-150 |
| D5-NEtFOSAA | M-03 | 82 | 20-150 |
| D7-NMeFOSE | | 68 | 20-150 |
| D9-NEtFOSE | | 69 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10916-002
Batch: 10916
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/01/2024 1538

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 100 | | 1 | 114 | 40-150 | 05/04/2024 1159 |
| 9Cl-PF3ONS | 90 | 96 | | 1 | 107 | 40-150 | 05/04/2024 1159 |
| ADONA | 91 | 100 | | 1 | 111 | 40-150 | 05/04/2024 1159 |
| 8:2FTS | 92 | 89 | | 1 | 97 | 40-150 | 05/04/2024 1159 |
| 4:2FTS | 90 | 91 | | 1 | 101 | 40-150 | 05/04/2024 1159 |
| 6:2FTS | 91 | 85 | | 1 | 93 | 40-150 | 05/04/2024 1159 |
| 5:3FTCA | 600 | 630 | | 1 | 105 | 40-150 | 05/04/2024 1159 |
| HFPO-DA | 96 | 100 | | 1 | 107 | 40-150 | 05/04/2024 1159 |
| NEtFOSA | 24 | 22 | | 1 | 93 | 40-150 | 05/04/2024 1159 |
| NEtFOSAA | 24 | 25 | | 1 | 104 | 40-150 | 05/04/2024 1159 |
| NEtFOSE | 240 | 230 | | 1 | 96 | 40-150 | 05/04/2024 1159 |
| NMeFOSA | 24 | 24 | | 1 | 98 | 40-150 | 05/04/2024 1159 |
| NMeFOSAA | 24 | 24 | M-03 | 1 | 102 | 40-150 | 05/04/2024 1159 |
| NMeFOSE | 240 | 220 | | 1 | 93 | 40-150 | 05/04/2024 1159 |
| NFDHA | 48 | 47 | | 1 | 98 | 40-150 | 05/04/2024 1159 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 46 | | 1 | 108 | 40-150 | 05/04/2024 1159 |
| PFMPA | 48 | 53 | | 1 | 110 | 40-150 | 05/04/2024 1159 |
| PFMBA | 48 | 48 | | 1 | 101 | 40-150 | 05/04/2024 1159 |
| PFBS | 21 | 21 | | 1 | 100 | 40-150 | 05/04/2024 1159 |
| PFBA | 96 | 98 | | 1 | 102 | 40-150 | 05/04/2024 1159 |
| PFDS | 23 | 22 | | 1 | 94 | 40-150 | 05/04/2024 1159 |
| PFDA | 24 | 26 | | 1 | 109 | 40-150 | 05/04/2024 1159 |
| PFDoS | 23 | 20 | | 1 | 86 | 40-150 | 05/04/2024 1159 |
| PFDoA | 24 | 24 | | 1 | 101 | 40-150 | 05/04/2024 1159 |
| PFHpS | 23 | 23 | | 1 | 101 | 40-150 | 05/04/2024 1159 |
| PFHpA | 24 | 25 | | 1 | 104 | 40-150 | 05/04/2024 1159 |
| 7:3FTCA | 600 | 600 | | 1 | 100 | 40-150 | 05/04/2024 1159 |
| PFHxS | 22 | 23 | M-03 | 1 | 104 | 40-150 | 05/04/2024 1159 |
| PFHxA | 24 | 23 | | 1 | 96 | 40-150 | 05/04/2024 1159 |
| PFNS | 23 | 22 | | 1 | 96 | 40-150 | 05/04/2024 1159 |
| PFNA | 24 | 27 | | 1 | 113 | 40-150 | 05/04/2024 1159 |
| PFOSA | 24 | 25 | | 1 | 105 | 40-150 | 05/04/2024 1159 |
| PFOS | 22 | 22 | M-03 | 1 | 101 | 40-150 | 05/04/2024 1159 |
| PFOA | 24 | 24 | | 1 | 101 | 40-150 | 05/04/2024 1159 |
| PFPeS | 23 | 23 | | 1 | 101 | 40-150 | 05/04/2024 1159 |
| PFPeA | 48 | 45 | | 1 | 94 | 40-150 | 05/04/2024 1159 |
| 3:3FTCA | 120 | 130 | | 1 | 108 | 40-150 | 05/04/2024 1159 |
| PFTeDA | 24 | 24 | | 1 | 99 | 40-150 | 05/04/2024 1159 |
| PFTrDA | 24 | 24 | | 1 | 99 | 40-150 | 05/04/2024 1159 |
| PFUnA | 24 | 25 | | 1 | 103 | 40-150 | 05/04/2024 1159 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 86 | 20-150 |
| 13C2-6:2FTS | | 92 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10916-002
Batch: 10916
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/01/2024 1538

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 89 | 20-150 |
| 13C2-PFDoA | | 77 | 20-150 |
| 13C2-PFTeDA | | 74 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 |
| 13C3-PFBS | | 90 | 20-150 |
| 13C3-PFHxS | | 90 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 |
| 13C4-PFHpA | | 90 | 20-150 |
| 13C5-PFHxA | | 90 | 20-150 |
| 13C5-PFPeA | | 91 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 |
| 13C7-PFUnA | | 82 | 20-150 |
| 13C8-PFOA | | 92 | 20-150 |
| 13C8-PFOS | | 87 | 20-150 |
| 13C8-PFOSA | | 75 | 20-150 |
| 13C9-PFNA | | 78 | 20-150 |
| D3-NMeFOSA | | 54 | 20-150 |
| D3-NMeFOSAA | | 81 | 20-150 |
| D5-NEtFOSA | | 57 | 20-150 |
| D5-NEtFOSAA | | 78 | 20-150 |
| D7-NMeFOSE | | 72 | 20-150 |
| D9-NEtFOSE | | 70 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10916-102
Batch: 10916
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/01/2024 1538

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.2 | | 1 | 95 | 40-150 | 05/04/2024 1208 |
| 9Cl-PF3ONS | 7.5 | 7.1 | | 1 | 96 | 40-150 | 05/04/2024 1208 |
| ADONA | 7.6 | 8.1 | | 1 | 107 | 40-150 | 05/04/2024 1208 |
| 8:2FTS | 7.7 | 8.5 | | 1 | 111 | 40-150 | 05/04/2024 1208 |
| 4:2FTS | 7.5 | 8.1 | | 1 | 109 | 40-150 | 05/04/2024 1208 |
| 6:2FTS | 7.6 | 8.7 | | 1 | 115 | 40-150 | 05/04/2024 1208 |
| 5:3FTCA | 50 | 51 | M-03 | 1 | 101 | 40-150 | 05/04/2024 1208 |
| HFPO-DA | 8.0 | 9.6 | | 1 | 121 | 40-150 | 05/04/2024 1208 |
| NEtFOSA | 2.0 | 1.9 | | 1 | 97 | 40-150 | 05/04/2024 1208 |
| NEtFOSAA | 2.0 | 2.2 | M-03 | 1 | 112 | 40-150 | 05/04/2024 1208 |
| NEtFOSE | 20 | 19 | | 1 | 96 | 40-150 | 05/04/2024 1208 |
| NMeFOSA | 2.0 | 1.9 | | 1 | 93 | 40-150 | 05/04/2024 1208 |
| NMeFOSAA | 2.0 | 2.5 | M-03 | 1 | 124 | 40-150 | 05/04/2024 1208 |
| NMeFOSE | 20 | 19 | | 1 | 95 | 40-150 | 05/04/2024 1208 |
| NFDHA | 4.0 | 4.3 | | 1 | 108 | 40-150 | 05/04/2024 1208 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.8 | | 1 | 108 | 40-150 | 05/04/2024 1208 |
| PFMPA | 4.0 | 4.5 | | 1 | 113 | 40-150 | 05/04/2024 1208 |
| PFMBA | 4.0 | 4.1 | | 1 | 103 | 40-150 | 05/04/2024 1208 |
| PFBS | 1.8 | 1.9 | M-03 | 1 | 107 | 40-150 | 05/04/2024 1208 |
| PFBA | 8.0 | 8.1 | | 1 | 102 | 40-150 | 05/04/2024 1208 |
| PFDS | 1.9 | 1.7 | | 1 | 89 | 40-150 | 05/04/2024 1208 |
| PFDA | 2.0 | 1.9 | M-03 | 1 | 96 | 40-150 | 05/04/2024 1208 |
| PFDoS | 1.9 | 1.7 | | 1 | 88 | 40-150 | 05/04/2024 1208 |
| PFDoA | 2.0 | 2.0 | M-03 | 1 | 100 | 40-150 | 05/04/2024 1208 |
| PFHpS | 1.9 | 2.0 | M-03 | 1 | 104 | 40-150 | 05/04/2024 1208 |
| PFHpA | 2.0 | 2.1 | | 1 | 106 | 40-150 | 05/04/2024 1208 |
| 7:3FTCA | 50 | 50 | M-03 | 1 | 101 | 40-150 | 05/04/2024 1208 |
| PFHxS | 1.8 | 1.4 | M-03 | 1 | 78 | 40-150 | 05/04/2024 1208 |
| PFHxA | 2.0 | 2.1 | M-03 | 1 | 106 | 40-150 | 05/04/2024 1208 |
| PFNS | 1.9 | 1.8 | | 1 | 92 | 40-150 | 05/04/2024 1208 |
| PFNA | 2.0 | 1.9 | M-03 | 1 | 95 | 40-150 | 05/04/2024 1208 |
| PFOSA | 2.0 | 2.2 | | 1 | 110 | 40-150 | 05/04/2024 1208 |
| PFOS | 1.9 | 1.9 | | 1 | 101 | 40-150 | 05/04/2024 1208 |
| PFOA | 2.0 | 2.2 | | 1 | 110 | 40-150 | 05/04/2024 1208 |
| PFPeS | 1.9 | 1.5 | M-03 | 1 | 80 | 40-150 | 05/04/2024 1208 |
| PFPeA | 4.0 | 4.0 | | 1 | 99 | 40-150 | 05/04/2024 1208 |
| 3:3FTCA | 10 | 12 | | 1 | 119 | 40-150 | 05/04/2024 1208 |
| PFTeDA | 2.0 | 2.1 | M-03 | 1 | 107 | 40-150 | 05/04/2024 1208 |
| PFTrDA | 2.0 | 2.1 | M-03 | 1 | 106 | 40-150 | 05/04/2024 1208 |
| PFUnA | 2.0 | 1.9 | | 1 | 93 | 40-150 | 05/04/2024 1208 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 90 | 20-150 |
| 13C2-6:2FTS | | 91 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ10916-102
Batch: 10916
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/01/2024 1538

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 82 | 20-150 |
| 13C2-PFDoA | | 71 | 20-150 |
| 13C2-PFTeDA | | 64 | 20-150 |
| 13C3-HFPO-DA | | 85 | 20-150 |
| 13C3-PFBS | | 90 | 20-150 |
| 13C3-PFHxS | | 98 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 |
| 13C5-PFHxA | | 84 | 20-150 |
| 13C5-PFPeA | | 84 | 20-150 |
| 13C6-PFDA | | 78 | 20-150 |
| 13C7-PFUnA | | 74 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 |
| 13C8-PFOS | | 86 | 20-150 |
| 13C8-PFOSA | | 77 | 20-150 |
| 13C9-PFNA | | 83 | 20-150 |
| D3-NMeFOSA | | 55 | 20-150 |
| D3-NMeFOSAA | | 78 | 20-150 |
| D5-NEtFOSA | | 54 | 20-150 |
| D5-NEtFOSAA | | 75 | 20-150 |
| D7-NMeFOSE | | 71 | 20-150 |
| D9-NEtFOSE | | 70 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ11072-001
Batch: 11072
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/03/2024 0750

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 05/07/2024 0403 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 05/07/2024 0403 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 05/07/2024 0403 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 05/07/2024 0403 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 05/07/2024 0403 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 05/07/2024 0403 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 05/07/2024 0403 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 05/07/2024 0403 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 05/07/2024 0403 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 05/07/2024 0403 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 05/07/2024 0403 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 05/07/2024 0403 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 05/07/2024 0403 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 05/07/2024 0403 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 05/07/2024 0403 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 05/07/2024 0403 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 05/07/2024 0403 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 05/07/2024 0403 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 05/07/2024 0403 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 05/07/2024 0403 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 05/07/2024 0403 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 05/07/2024 0403 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 05/07/2024 0403 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 05/07/2024 0403 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 05/07/2024 0403 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 05/07/2024 0403 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 05/07/2024 0403 |
| PFHxS | 0.19 | JM-03 | 1 | 1.0 | 0.73 | 0.18 | ng/L | 05/07/2024 0403 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 05/07/2024 0403 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 05/07/2024 0403 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 05/07/2024 0403 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 05/07/2024 0403 |
| PFOS | 0.39 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 05/07/2024 0403 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 05/07/2024 0403 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 05/07/2024 0403 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 05/07/2024 0403 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 05/07/2024 0403 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 05/07/2024 0403 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 05/07/2024 0403 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 05/07/2024 0403 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 71 | 20-150 |
| 13C2-6:2FTS | M-03 | 69 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ11072-001
Batch: 11072
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/03/2024 0750

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 66 | 20-150 |
| 13C2-PFDoA | | 67 | 20-150 |
| 13C2-PFTeDA | | 70 | 20-150 |
| 13C3-HFPO-DA | | 70 | 20-150 |
| 13C3-PFBS | | 69 | 20-150 |
| 13C3-PFHxS | | 64 | 20-150 |
| 13C4-PFBA | | 70 | 20-150 |
| 13C4-PFHpA | | 65 | 20-150 |
| 13C5-PFHxA | | 68 | 20-150 |
| 13C5-PFPeA | | 68 | 20-150 |
| 13C6-PFDA | | 66 | 20-150 |
| 13C7-PFUnA | | 71 | 20-150 |
| 13C8-PFOA | | 63 | 20-150 |
| 13C8-PFOS | | 68 | 20-150 |
| 13C8-PFOSA | | 71 | 20-150 |
| 13C9-PFNA | | 64 | 20-150 |
| D3-NMeFOSA | | 64 | 20-150 |
| D3-NMeFOSAA | | 67 | 20-150 |
| D5-NEtFOSA | | 67 | 20-150 |
| D5-NEtFOSAA | | 66 | 20-150 |
| D7-NMeFOSE | | 71 | 20-150 |
| D9-NEtFOSE | | 70 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ11072-002
Batch: 11072
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/03/2024 0750

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 90 | | 1 | 99 | 40-150 | 05/07/2024 0412 |
| 9Cl-PF3ONS | 90 | 88 | | 1 | 98 | 40-150 | 05/07/2024 0412 |
| ADONA | 91 | 88 | | 1 | 97 | 40-150 | 05/07/2024 0412 |
| 8:2FTS | 92 | 96 | | 1 | 104 | 40-150 | 05/07/2024 0412 |
| 4:2FTS | 90 | 97 | | 1 | 108 | 40-150 | 05/07/2024 0412 |
| 6:2FTS | 91 | 92 | | 1 | 101 | 40-150 | 05/07/2024 0412 |
| 5:3FTCA | 600 | 570 | | 1 | 95 | 40-150 | 05/07/2024 0412 |
| HFPO-DA | 96 | 88 | | 1 | 92 | 40-150 | 05/07/2024 0412 |
| NEtFOSA | 24 | 23 | | 1 | 97 | 40-150 | 05/07/2024 0412 |
| NEtFOSAA | 24 | 25 | | 1 | 103 | 40-150 | 05/07/2024 0412 |
| NEtFOSE | 240 | 240 | | 1 | 98 | 40-150 | 05/07/2024 0412 |
| NMeFOSA | 24 | 22 | | 1 | 93 | 40-150 | 05/07/2024 0412 |
| NMeFOSAA | 24 | 24 | M-03 | 1 | 102 | 40-150 | 05/07/2024 0412 |
| NMeFOSE | 240 | 230 | | 1 | 97 | 40-150 | 05/07/2024 0412 |
| NFDHA | 48 | 45 | | 1 | 94 | 40-150 | 05/07/2024 0412 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 43 | | 1 | 100 | 40-150 | 05/07/2024 0412 |
| PFMPA | 48 | 50 | | 1 | 104 | 40-150 | 05/07/2024 0412 |
| PFMBA | 48 | 47 | | 1 | 97 | 40-150 | 05/07/2024 0412 |
| PFBS | 21 | 21 | | 1 | 100 | 40-150 | 05/07/2024 0412 |
| PFBA | 96 | 97 | | 1 | 101 | 40-150 | 05/07/2024 0412 |
| PFDS | 23 | 21 | | 1 | 92 | 40-150 | 05/07/2024 0412 |
| PFDA | 24 | 25 | | 1 | 105 | 40-150 | 05/07/2024 0412 |
| PFDoS | 23 | 22 | | 1 | 95 | 40-150 | 05/07/2024 0412 |
| PFDoA | 24 | 25 | | 1 | 103 | 40-150 | 05/07/2024 0412 |
| PFHpS | 23 | 21 | | 1 | 90 | 40-150 | 05/07/2024 0412 |
| PFHpA | 24 | 23 | | 1 | 97 | 40-150 | 05/07/2024 0412 |
| 7:3FTCA | 600 | 560 | | 1 | 93 | 40-150 | 05/07/2024 0412 |
| PFHxS | 22 | 20 | | 1 | 92 | 40-150 | 05/07/2024 0412 |
| PFHxA | 24 | 22 | | 1 | 92 | 40-150 | 05/07/2024 0412 |
| PFNS | 23 | 22 | | 1 | 95 | 40-150 | 05/07/2024 0412 |
| PFNA | 24 | 22 | | 1 | 93 | 40-150 | 05/07/2024 0412 |
| PFOSA | 24 | 24 | M-03 | 1 | 100 | 40-150 | 05/07/2024 0412 |
| PFOS | 22 | 20 | M-03 | 1 | 89 | 40-150 | 05/07/2024 0412 |
| PFOA | 24 | 24 | | 1 | 99 | 40-150 | 05/07/2024 0412 |
| PFPeS | 23 | 22 | | 1 | 99 | 40-150 | 05/07/2024 0412 |
| PFPeA | 48 | 46 | M-03 | 1 | 96 | 40-150 | 05/07/2024 0412 |
| 3:3FTCA | 120 | 120 | | 1 | 103 | 40-150 | 05/07/2024 0412 |
| PFTeDA | 24 | 25 | | 1 | 104 | 40-150 | 05/07/2024 0412 |
| PFTrDA | 24 | 24 | | 1 | 101 | 40-150 | 05/07/2024 0412 |
| PFUnA | 24 | 26 | | 1 | 107 | 40-150 | 05/07/2024 0412 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 63 | 20-150 |
| 13C2-6:2FTS | | 67 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ11072-002
Batch: 11072
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/03/2024 0750

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 60 | 20-150 |
| 13C2-PFDoA | | 66 | 20-150 |
| 13C2-PFTeDA | | 63 | 20-150 |
| 13C3-HFPO-DA | | 65 | 20-150 |
| 13C3-PFBS | | 65 | 20-150 |
| 13C3-PFHxS | | 70 | 20-150 |
| 13C4-PFBA | | 65 | 20-150 |
| 13C4-PFHpA | | 67 | 20-150 |
| 13C5-PFHxA | | 68 | 20-150 |
| 13C5-PFPeA | | 67 | 20-150 |
| 13C6-PFDA | | 62 | 20-150 |
| 13C7-PFUnA | | 63 | 20-150 |
| 13C8-PFOA | | 70 | 20-150 |
| 13C8-PFOS | | 68 | 20-150 |
| 13C8-PFOSA | | 61 | 20-150 |
| 13C9-PFNA | | 68 | 20-150 |
| D3-NMeFOSA | | 62 | 20-150 |
| D3-NMeFOSAA | | 65 | 20-150 |
| D5-NEtFOSA | | 60 | 20-150 |
| D5-NEtFOSAA | | 63 | 20-150 |
| D7-NMeFOSE | | 66 | 20-150 |
| D9-NEtFOSE | | 65 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ11072-102
Batch: 11072
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/03/2024 0750

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.1 | | 1 | 94 | 40-150 | 05/07/2024 0421 |
| 9Cl-PF3ONS | 7.5 | 6.9 | | 1 | 92 | 40-150 | 05/07/2024 0421 |
| ADONA | 7.6 | 6.9 | | 1 | 92 | 40-150 | 05/07/2024 0421 |
| 8:2FTS | 7.7 | 8.5 | M-03 | 1 | 110 | 40-150 | 05/07/2024 0421 |
| 4:2FTS | 7.5 | 7.3 | M-03 | 1 | 97 | 40-150 | 05/07/2024 0421 |
| 6:2FTS | 7.6 | 8.7 | | 1 | 115 | 40-150 | 05/07/2024 0421 |
| 5:3FTCA | 50 | 50 | | 1 | 100 | 40-150 | 05/07/2024 0421 |
| HFPO-DA | 8.0 | 8.5 | | 1 | 106 | 40-150 | 05/07/2024 0421 |
| NEtFOSA | 2.0 | 2.0 | | 1 | 102 | 40-150 | 05/07/2024 0421 |
| NEtFOSAA | 2.0 | 2.1 | M-03 | 1 | 106 | 40-150 | 05/07/2024 0421 |
| NEtFOSE | 20 | 18 | | 1 | 90 | 40-150 | 05/07/2024 0421 |
| NMeFOSA | 2.0 | 2.0 | | 1 | 100 | 40-150 | 05/07/2024 0421 |
| NMeFOSAA | 2.0 | 2.0 | M-03 | 1 | 101 | 40-150 | 05/07/2024 0421 |
| NMeFOSE | 20 | 18 | | 1 | 92 | 40-150 | 05/07/2024 0421 |
| NFDHA | 4.0 | 4.3 | M-03 | 1 | 108 | 40-150 | 05/07/2024 0421 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.6 | | 1 | 100 | 40-150 | 05/07/2024 0421 |
| PFMPA | 4.0 | 4.1 | | 1 | 102 | 40-150 | 05/07/2024 0421 |
| PFMBA | 4.0 | 3.7 | | 1 | 93 | 40-150 | 05/07/2024 0421 |
| PFBS | 1.8 | 1.9 | | 1 | 108 | 40-150 | 05/07/2024 0421 |
| PFBA | 8.0 | 7.9 | | 1 | 99 | 40-150 | 05/07/2024 0421 |
| PFDS | 1.9 | 1.9 | | 1 | 97 | 40-150 | 05/07/2024 0421 |
| PFDA | 2.0 | 1.8 | M-03 | 1 | 90 | 40-150 | 05/07/2024 0421 |
| PFDoS | 1.9 | 1.9 | | 1 | 98 | 40-150 | 05/07/2024 0421 |
| PFDoA | 2.0 | 1.9 | M-03 | 1 | 95 | 40-150 | 05/07/2024 0421 |
| PFHpS | 1.9 | 1.8 | M-03 | 1 | 96 | 40-150 | 05/07/2024 0421 |
| PFHpA | 2.0 | 1.8 | M-03 | 1 | 92 | 40-150 | 05/07/2024 0421 |
| 7:3FTCA | 50 | 47 | | 1 | 93 | 40-150 | 05/07/2024 0421 |
| PFHxS | 1.8 | 1.9 | M-03 | 1 | 103 | 40-150 | 05/07/2024 0421 |
| PFHxA | 2.0 | 2.0 | M-03 | 1 | 100 | 40-150 | 05/07/2024 0421 |
| PFNS | 1.9 | 2.2 | | 1 | 114 | 40-150 | 05/07/2024 0421 |
| PFNA | 2.0 | 1.9 | M-03 | 1 | 95 | 40-150 | 05/07/2024 0421 |
| PFOSA | 2.0 | 1.9 | M-03 | 1 | 95 | 40-150 | 05/07/2024 0421 |
| PFOS | 1.9 | 1.9 | M-03 | 1 | 101 | 40-150 | 05/07/2024 0421 |
| PFOA | 2.0 | 1.6 | M-03 | 1 | 80 | 40-150 | 05/07/2024 0421 |
| PFPeS | 1.9 | 1.9 | | 1 | 101 | 40-150 | 05/07/2024 0421 |
| PFPeA | 4.0 | 4.1 | | 1 | 103 | 40-150 | 05/07/2024 0421 |
| 3:3FTCA | 10 | 10 | M-03 | 1 | 103 | 40-150 | 05/07/2024 0421 |
| PFTeDA | 2.0 | 1.6 | | 1 | 79 | 40-150 | 05/07/2024 0421 |
| PFTrDA | 2.0 | 1.9 | M-03 | 1 | 97 | 40-150 | 05/07/2024 0421 |
| PFUnA | 2.0 | 1.7 | M-03 | 1 | 85 | 40-150 | 05/07/2024 0421 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 65 | 20-150 |
| 13C2-6:2FTS | | 64 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ11072-102
Batch: 11072
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/03/2024 0750

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 61 | 20-150 |
| 13C2-PFDoA | | 67 | 20-150 |
| 13C2-PFTeDA | | 69 | 20-150 |
| 13C3-HFPO-DA | | 74 | 20-150 |
| 13C3-PFBS | | 63 | 20-150 |
| 13C3-PFHxS | | 61 | 20-150 |
| 13C4-PFBA | | 67 | 20-150 |
| 13C4-PFHpA | | 68 | 20-150 |
| 13C5-PFHxA | | 68 | 20-150 |
| 13C5-PFPeA | | 67 | 20-150 |
| 13C6-PFDA | M-03 | 70 | 20-150 |
| 13C7-PFUnA | | 68 | 20-150 |
| 13C8-PFOA | | 68 | 20-150 |
| 13C8-PFOS | | 66 | 20-150 |
| 13C8-PFOSA | | 67 | 20-150 |
| 13C9-PFNA | | 69 | 20-150 |
| D3-NMeFOSA | | 63 | 20-150 |
| D3-NMeFOSAA | | 62 | 20-150 |
| D5-NEtFOSA | | 65 | 20-150 |
| D5-NEtFOSAA | | 69 | 20-150 |
| D7-NMeFOSE | | 68 | 20-150 |
| D9-NEtFOSE | | 67 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: ZD05031-027DU
Batch: 11072
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/03/2024 0750

| Parameter | Sample Amount (ng/L) | Result (ng/L) | Q | Dil | % RPD | %RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| 9Cl-PF3ONS | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| ADONA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| 8:2FTS | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| 4:2FTS | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| 6:2FTS | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| 5:3FTCA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| HFPO-DA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| NEtFOSA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| NEtFOSAA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| NEtFOSE | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| NMeFOSA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| NMeFOSAA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| NMeFOSE | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| NFDHA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFMPA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFMBA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFBS | 5.6 | 5.2 | JM-03 | 1 | 8.2 | 20 | 05/07/2024 1612 |
| PFBA | ND | ND | M-03 | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFDS | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFDA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFDoS | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFDoA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFHpS | 8.3 | 10 | JM-03,+ | 1 | 21 | 20 | 05/07/2024 1612 |
| PFHpA | 5.8 | 7.5 | JM-03,+ | 1 | 26 | 20 | 05/07/2024 1612 |
| 7:3FTCA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFHxS | 160 | 140 | | 1 | 17 | 20 | 05/07/2024 1612 |
| PFHxA | 12 | 13 | JM-03 | 1 | 8.6 | 20 | 05/07/2024 1612 |
| PFNS | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFNA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFOSA | 5.1 | 4.1 | JM-03,+ | 1 | 22 | 20 | 05/07/2024 1612 |
| PFOS | 620 | 630 | M-03 | 1 | 0.93 | 20 | 05/07/2024 1612 |
| PFOA | 24 | 23 | | 1 | 4.4 | 20 | 05/07/2024 1612 |
| PFPeS | 8.6 | 9.3 | J | 1 | 8.0 | 20 | 05/07/2024 1612 |
| PFPeA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| 3:3FTCA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFTeDA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFTrDA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |
| PFUnA | ND | ND | | 1 | 0.00 | 20 | 05/07/2024 1612 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 77 | 20-150 |
| 13C2-6:2FTS | | 80 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - Duplicate

Sample ID: ZD05031-027DU
Batch: 11072
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/03/2024 0750

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 72 | 20-150 |
| 13C2-PFDoA | | 73 | 20-150 |
| 13C2-PFTeDA | | 69 | 20-150 |
| 13C3-HFPO-DA | | 81 | 20-150 |
| 13C3-PFBS | | 75 | 20-150 |
| 13C3-PFHxS | | 77 | 20-150 |
| 13C4-PFBA | | 77 | 20-150 |
| 13C4-PFHpA | | 78 | 20-150 |
| 13C5-PFHxA | | 78 | 20-150 |
| 13C5-PFPeA | | 78 | 20-150 |
| 13C6-PFDA | | 76 | 20-150 |
| 13C7-PFUnA | | 73 | 20-150 |
| 13C8-PFOA | | 70 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 |
| 13C8-PFOSA | | 77 | 20-150 |
| 13C9-PFNA | | 85 | 20-150 |
| D3-NMeFOSA | | 52 | 20-150 |
| D3-NMeFOSAA | | 74 | 20-150 |
| D5-NEtFOSA | | 53 | 20-150 |
| D5-NEtFOSAA | | 75 | 20-150 |
| D7-NMeFOSE | | 70 | 20-150 |
| D9-NEtFOSE | | 70 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZD05031-027MS
Batch: 11072
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/03/2024 0750

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 1800 | 1800 | | 1 | 97 | 40-150 | 05/07/2024 1621 |
| 9Cl-PF3ONS | ND | 1800 | 1900 | | 1 | 106 | 40-150 | 05/07/2024 1621 |
| ADONA | ND | 1800 | 2100 | | 1 | 113 | 40-150 | 05/07/2024 1621 |
| 8:2FTS | ND | 1800 | 2000 | | 1 | 110 | 40-150 | 05/07/2024 1621 |
| 4:2FTS | ND | 1800 | 2200 | | 1 | 120 | 40-150 | 05/07/2024 1621 |
| 6:2FTS | ND | 1800 | 2100 | | 1 | 117 | 40-150 | 05/07/2024 1621 |
| 5:3FTCA | ND | 12000 | 13000 | | 1 | 109 | 40-150 | 05/07/2024 1621 |
| HFPO-DA | ND | 1900 | 2200 | | 1 | 117 | 40-150 | 05/07/2024 1621 |
| NEtFOSA | ND | 480 | 490 | | 1 | 102 | 40-150 | 05/07/2024 1621 |
| NEtFOSAA | ND | 480 | 520 | | 1 | 109 | 40-150 | 05/07/2024 1621 |
| NEtFOSE | ND | 4800 | 5100 | | 1 | 106 | 40-150 | 05/07/2024 1621 |
| NMeFOSA | ND | 480 | 540 | M-03 | 1 | 112 | 40-150 | 05/07/2024 1621 |
| NMeFOSAA | ND | 480 | 540 | M-03 | 1 | 112 | 40-150 | 05/07/2024 1621 |
| NMeFOSE | ND | 4800 | 5100 | | 1 | 105 | 40-150 | 05/07/2024 1621 |
| NFDHA | ND | 960 | 1000 | | 1 | 105 | 40-150 | 05/07/2024 1621 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 850 | 880 | | 1 | 103 | 40-150 | 05/07/2024 1621 |
| PFMPA | ND | 960 | 1100 | | 1 | 117 | 40-150 | 05/07/2024 1621 |
| PFMBA | ND | 960 | 1100 | | 1 | 110 | 40-150 | 05/07/2024 1621 |
| PFBS | 5.6 | 430 | 480 | | 1 | 111 | 40-150 | 05/07/2024 1621 |
| PFBA | ND | 1900 | 2100 | | 1 | 108 | 40-150 | 05/07/2024 1621 |
| PFDS | ND | 460 | 470 | | 1 | 101 | 40-150 | 05/07/2024 1621 |
| PFDA | ND | 480 | 480 | | 1 | 101 | 40-150 | 05/07/2024 1621 |
| PFDoS | ND | 470 | 450 | | 1 | 96 | 40-150 | 05/07/2024 1621 |
| PFDoA | ND | 480 | 520 | | 1 | 109 | 40-150 | 05/07/2024 1621 |
| PFHpS | 8.3 | 460 | 440 | | 1 | 95 | 40-150 | 05/07/2024 1621 |
| PFHpA | 5.8 | 480 | 530 | | 1 | 108 | 40-150 | 05/07/2024 1621 |
| 7:3FTCA | ND | 12000 | 13000 | | 1 | 108 | 40-150 | 05/07/2024 1621 |
| PFHxS | 160 | 440 | 630 | | 1 | 106 | 40-150 | 05/07/2024 1621 |
| PFHxA | 12 | 480 | 510 | | 1 | 104 | 40-150 | 05/07/2024 1621 |
| PFNS | ND | 460 | 480 | | 1 | 104 | 40-150 | 05/07/2024 1621 |
| PFNA | ND | 480 | 490 | | 1 | 103 | 40-150 | 05/07/2024 1621 |
| PFOSA | 5.1 | 480 | 520 | M-03 | 1 | 108 | 40-150 | 05/07/2024 1621 |
| PFOS | 620 | 450 | 1100 | M-03 | 1 | 108 | 40-150 | 05/07/2024 1621 |
| PFOA | 24 | 480 | 540 | M-03 | 1 | 106 | 40-150 | 05/07/2024 1621 |
| PFPeS | 8.6 | 450 | 540 | | 1 | 119 | 40-150 | 05/07/2024 1621 |
| PFPeA | ND | 960 | 1100 | | 1 | 110 | 40-150 | 05/07/2024 1621 |
| 3:3FTCA | ND | 2400 | 3000 | | 1 | 123 | 40-150 | 05/07/2024 1621 |
| PFTeDA | ND | 480 | 550 | | 1 | 114 | 40-150 | 05/07/2024 1621 |
| PFTrDA | ND | 480 | 550 | | 1 | 115 | 40-150 | 05/07/2024 1621 |
| PFUnA | ND | 480 | 540 | | 1 | 112 | 40-150 | 05/07/2024 1621 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 75 | 20-150 |
| 13C2-6:2FTS | | 74 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZD05031-027MS
Batch: 11072
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/03/2024 0750

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 75 | 20-150 |
| 13C2-PFDoA | | 75 | 20-150 |
| 13C2-PFTeDA | | 71 | 20-150 |
| 13C3-HFPO-DA | | 78 | 20-150 |
| 13C3-PFBS | | 76 | 20-150 |
| 13C3-PFHxS | | 72 | 20-150 |
| 13C4-PFBA | | 78 | 20-150 |
| 13C4-PFHpA | | 75 | 20-150 |
| 13C5-PFHxA | | 80 | 20-150 |
| 13C5-PFPeA | | 76 | 20-150 |
| 13C6-PFDA | | 80 | 20-150 |
| 13C7-PFUnA | | 74 | 20-150 |
| 13C8-PFOA | | 87 | 20-150 |
| 13C8-PFOS | | 78 | 20-150 |
| 13C8-PFOSA | | 79 | 20-150 |
| 13C9-PFNA | | 82 | 20-150 |
| D3-NMeFOSA | | 54 | 20-150 |
| D3-NMeFOSAA | | 74 | 20-150 |
| D5-NEtFOSA | | 54 | 20-150 |
| D5-NEtFOSAA | | 75 | 20-150 |
| D7-NMeFOSE | | 72 | 20-150 |
| D9-NEtFOSE | | 70 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ11501-001
Batch: 11501
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/11/2024 0844

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 05/13/2024 1923 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 05/13/2024 1923 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 05/13/2024 1923 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 05/13/2024 1923 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 05/13/2024 1923 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 05/13/2024 1923 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 05/13/2024 1923 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 05/13/2024 1923 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 05/13/2024 1923 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 05/13/2024 1923 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 05/13/2024 1923 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 05/13/2024 1923 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 05/13/2024 1923 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 05/13/2024 1923 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 05/13/2024 1923 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 05/13/2024 1923 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 05/13/2024 1923 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 05/13/2024 1923 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 05/13/2024 1923 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 05/13/2024 1923 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 05/13/2024 1923 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 05/13/2024 1923 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 05/13/2024 1923 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 05/13/2024 1923 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 05/13/2024 1923 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 05/13/2024 1923 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 05/13/2024 1923 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 05/13/2024 1923 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 05/13/2024 1923 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 05/13/2024 1923 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 05/13/2024 1923 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 05/13/2024 1923 |
| PFOS | 0.33 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 05/13/2024 1923 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 05/13/2024 1923 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 05/13/2024 1923 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 05/13/2024 1923 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 05/13/2024 1923 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 05/13/2024 1923 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 05/13/2024 1923 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 05/13/2024 1923 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 110 | 20-150 |
| 13C2-6:2FTS | | 105 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ11501-001
Batch: 11501
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/11/2024 0844

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 91 | 20-150 |
| 13C2-PFDoA | | 88 | 20-150 |
| 13C2-PFTeDA | | 81 | 20-150 |
| 13C3-HFPO-DA | | 96 | 20-150 |
| 13C3-PFBS | | 101 | 20-150 |
| 13C3-PFHxS | | 100 | 20-150 |
| 13C4-PFBA | | 101 | 20-150 |
| 13C4-PFHpA | | 96 | 20-150 |
| 13C5-PFHxA | | 100 | 20-150 |
| 13C5-PFPeA | | 97 | 20-150 |
| 13C6-PFDA | | 100 | 20-150 |
| 13C7-PFUnA | | 102 | 20-150 |
| 13C8-PFOA | | 105 | 20-150 |
| 13C8-PFOS | | 93 | 20-150 |
| 13C8-PFOSA | | 102 | 20-150 |
| 13C9-PFNA | | 99 | 20-150 |
| D3-NMeFOSA | | 80 | 20-150 |
| D3-NMeFOSAA | | 95 | 20-150 |
| D5-NEtFOSA | | 83 | 20-150 |
| D5-NEtFOSAA | | 91 | 20-150 |
| D7-NMeFOSE | | 102 | 20-150 |
| D9-NEtFOSE | | 102 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ11501-002
Batch: 11501
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/11/2024 0844

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 91 | | 1 | 101 | 40-150 | 05/13/2024 1932 |
| 9Cl-PF3ONS | 90 | 100 | | 1 | 116 | 40-150 | 05/13/2024 1932 |
| ADONA | 91 | 120 | | 1 | 128 | 40-150 | 05/13/2024 1932 |
| 8:2FTS | 92 | 100 | | 1 | 109 | 40-150 | 05/13/2024 1932 |
| 4:2FTS | 90 | 92 | | 1 | 103 | 40-150 | 05/13/2024 1932 |
| 6:2FTS | 91 | 96 | | 1 | 105 | 40-150 | 05/13/2024 1932 |
| 5:3FTCA | 600 | 680 | | 1 | 114 | 40-150 | 05/13/2024 1932 |
| HFPO-DA | 96 | 120 | | 1 | 125 | 40-150 | 05/13/2024 1932 |
| NEtFOSA | 24 | 25 | | 1 | 104 | 40-150 | 05/13/2024 1932 |
| NEtFOSAA | 24 | 24 | | 1 | 101 | 40-150 | 05/13/2024 1932 |
| NEtFOSE | 240 | 250 | | 1 | 103 | 40-150 | 05/13/2024 1932 |
| NMeFOSA | 24 | 24 | | 1 | 101 | 40-150 | 05/13/2024 1932 |
| NMeFOSAA | 24 | 26 | M-03 | 1 | 106 | 40-150 | 05/13/2024 1932 |
| NMeFOSE | 240 | 240 | | 1 | 102 | 40-150 | 05/13/2024 1932 |
| NFDHA | 48 | 62 | | 1 | 130 | 40-150 | 05/13/2024 1932 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 56 | | 1 | 132 | 40-150 | 05/13/2024 1932 |
| PFMPA | 48 | 69 | | 1 | 144 | 40-150 | 05/13/2024 1932 |
| PFMBA | 48 | 65 | | 1 | 136 | 40-150 | 05/13/2024 1932 |
| PFBS | 21 | 24 | | 1 | 113 | 40-150 | 05/13/2024 1932 |
| PFBA | 96 | 100 | | 1 | 108 | 40-150 | 05/13/2024 1932 |
| PFDS | 23 | 22 | | 1 | 93 | 40-150 | 05/13/2024 1932 |
| PFDA | 24 | 23 | | 1 | 98 | 40-150 | 05/13/2024 1932 |
| PFDoS | 23 | 18 | | 1 | 78 | 40-150 | 05/13/2024 1932 |
| PFDoA | 24 | 27 | | 1 | 111 | 40-150 | 05/13/2024 1932 |
| PFHpS | 23 | 24 | | 1 | 104 | 40-150 | 05/13/2024 1932 |
| PFHpA | 24 | 26 | | 1 | 107 | 40-150 | 05/13/2024 1932 |
| 7:3FTCA | 600 | 610 | | 1 | 102 | 40-150 | 05/13/2024 1932 |
| PFHxS | 22 | 24 | | 1 | 108 | 40-150 | 05/13/2024 1932 |
| PFHxA | 24 | 24 | | 1 | 100 | 40-150 | 05/13/2024 1932 |
| PFNS | 23 | 24 | | 1 | 103 | 40-150 | 05/13/2024 1932 |
| PFNA | 24 | 25 | | 1 | 102 | 40-150 | 05/13/2024 1932 |
| PFOSA | 24 | 26 | | 1 | 108 | 40-150 | 05/13/2024 1932 |
| PFOS | 22 | 24 | M-03 | 1 | 107 | 40-150 | 05/13/2024 1932 |
| PFOA | 24 | 24 | | 1 | 102 | 40-150 | 05/13/2024 1932 |
| PFPeS | 23 | 27 | | 1 | 122 | 40-150 | 05/13/2024 1932 |
| PFPeA | 48 | 51 | | 1 | 106 | 40-150 | 05/13/2024 1932 |
| 3:3FTCA | 120 | 150 | | 1 | 128 | 40-150 | 05/13/2024 1932 |
| PFTeDA | 24 | 27 | | 1 | 114 | 40-150 | 05/13/2024 1932 |
| PFTrDA | 24 | 23 | | 1 | 97 | 40-150 | 05/13/2024 1932 |
| PFUnA | 24 | 25 | | 1 | 103 | 40-150 | 05/13/2024 1932 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 94 | 20-150 |
| 13C2-6:2FTS | | 93 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ11501-002
Batch: 11501
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/11/2024 0844

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 85 | 20-150 |
| 13C2-PFDoA | | 80 | 20-150 |
| 13C2-PFTeDA | | 62 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 |
| 13C3-PFBS | | 89 | 20-150 |
| 13C3-PFHxS | | 85 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 |
| 13C5-PFHxA | | 91 | 20-150 |
| 13C5-PFPeA | | 90 | 20-150 |
| 13C6-PFDA | | 95 | 20-150 |
| 13C7-PFUnA | | 90 | 20-150 |
| 13C8-PFOA | | 88 | 20-150 |
| 13C8-PFOS | | 88 | 20-150 |
| 13C8-PFOSA | | 90 | 20-150 |
| 13C9-PFNA | | 89 | 20-150 |
| D3-NMeFOSA | | 79 | 20-150 |
| D3-NMeFOSAA | | 86 | 20-150 |
| D5-NEtFOSA | | 80 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 |
| D7-NMeFOSE | | 100 | 20-150 |
| D9-NEtFOSE | | 97 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ11501-102
Batch: 11501
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/11/2024 0844

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.3 | | 1 | 96 | 40-150 | 05/13/2024 1941 |
| 9Cl-PF3ONS | 7.5 | 8.3 | | 1 | 111 | 40-150 | 05/13/2024 1941 |
| ADONA | 7.6 | 9.3 | | 1 | 123 | 40-150 | 05/13/2024 1941 |
| 8:2FTS | 7.7 | 8.5 | | 1 | 111 | 40-150 | 05/13/2024 1941 |
| 4:2FTS | 7.5 | 8.4 | | 1 | 112 | 40-150 | 05/13/2024 1941 |
| 6:2FTS | 7.6 | 10 | | 1 | 132 | 40-150 | 05/13/2024 1941 |
| 5:3FTCA | 50 | 61 | | 1 | 122 | 40-150 | 05/13/2024 1941 |
| HFPO-DA | 8.0 | 8.0 | M-03 | 1 | 100 | 40-150 | 05/13/2024 1941 |
| NEtFOSA | 2.0 | 2.0 | | 1 | 100 | 40-150 | 05/13/2024 1941 |
| NEtFOSAA | 2.0 | 2.2 | M-03 | 1 | 109 | 40-150 | 05/13/2024 1941 |
| NEtFOSE | 20 | 22 | | 1 | 110 | 40-150 | 05/13/2024 1941 |
| NMeFOSA | 2.0 | 2.4 | | 1 | 119 | 40-150 | 05/13/2024 1941 |
| NMeFOSAA | 2.0 | 2.4 | | 1 | 120 | 40-150 | 05/13/2024 1941 |
| NMeFOSE | 20 | 21 | | 1 | 107 | 40-150 | 05/13/2024 1941 |
| NFDHA | 4.0 | 5.0 | | 1 | 124 | 40-150 | 05/13/2024 1941 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.1 | | 1 | 114 | 40-150 | 05/13/2024 1941 |
| PFMPA | 4.0 | 4.8 | | 1 | 120 | 40-150 | 05/13/2024 1941 |
| PFMBA | 4.0 | 4.6 | | 1 | 115 | 40-150 | 05/13/2024 1941 |
| PFBS | 1.8 | 2.1 | | 1 | 121 | 40-150 | 05/13/2024 1941 |
| PFBA | 8.0 | 9.2 | | 1 | 116 | 40-150 | 05/13/2024 1941 |
| PFDS | 1.9 | 1.8 | | 1 | 92 | 40-150 | 05/13/2024 1941 |
| PFDA | 2.0 | 2.4 | M-03 | 1 | 120 | 40-150 | 05/13/2024 1941 |
| PFDoS | 1.9 | 2.0 | | 1 | 104 | 40-150 | 05/13/2024 1941 |
| PFDoA | 2.0 | 2.3 | M-03 | 1 | 113 | 40-150 | 05/13/2024 1941 |
| PFHpS | 1.9 | 2.0 | M-03 | 1 | 107 | 40-150 | 05/13/2024 1941 |
| PFHpA | 2.0 | 2.3 | | 1 | 115 | 40-150 | 05/13/2024 1941 |
| 7:3FTCA | 50 | 57 | | 1 | 113 | 40-150 | 05/13/2024 1941 |
| PFHxS | 1.8 | 2.2 | | 1 | 119 | 40-150 | 05/13/2024 1941 |
| PFHxA | 2.0 | 2.3 | M-03 | 1 | 114 | 40-150 | 05/13/2024 1941 |
| PFNS | 1.9 | 2.1 | | 1 | 111 | 40-150 | 05/13/2024 1941 |
| PFNA | 2.0 | 2.1 | M-03 | 1 | 105 | 40-150 | 05/13/2024 1941 |
| PFOSA | 2.0 | 2.3 | | 1 | 115 | 40-150 | 05/13/2024 1941 |
| PFOS | 1.9 | 2.0 | M-03 | 1 | 110 | 40-150 | 05/13/2024 1941 |
| PFOA | 2.0 | 1.8 | | 1 | 92 | 40-150 | 05/13/2024 1941 |
| PFPeS | 1.9 | 2.2 | | 1 | 117 | 40-150 | 05/13/2024 1941 |
| PFPeA | 4.0 | 4.8 | | 1 | 119 | 40-150 | 05/13/2024 1941 |
| 3:3FTCA | 10 | 13 | | 1 | 127 | 40-150 | 05/13/2024 1941 |
| PFTeDA | 2.0 | 2.2 | M-03 | 1 | 110 | 40-150 | 05/13/2024 1941 |
| PFTrDA | 2.0 | 2.2 | M-03 | 1 | 112 | 40-150 | 05/13/2024 1941 |
| PFUnA | 2.0 | 2.4 | | 1 | 121 | 40-150 | 05/13/2024 1941 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 86 | 20-150 |
| 13C2-6:2FTS | | 87 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ11501-102
Batch: 11501
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/11/2024 0844

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 88 | 20-150 |
| 13C2-PFDoA | | 83 | 20-150 |
| 13C2-PFTeDA | | 78 | 20-150 |
| 13C3-HFPO-DA | | 88 | 20-150 |
| 13C3-PFBS | | 86 | 20-150 |
| 13C3-PFHxS | | 88 | 20-150 |
| 13C4-PFBA | | 86 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 |
| 13C5-PFHxA | | 91 | 20-150 |
| 13C5-PFPeA | | 92 | 20-150 |
| 13C6-PFDA | | 85 | 20-150 |
| 13C7-PFUnA | | 89 | 20-150 |
| 13C8-PFOA | | 89 | 20-150 |
| 13C8-PFOS | | 86 | 20-150 |
| 13C8-PFOSA | | 90 | 20-150 |
| 13C9-PFNA | | 83 | 20-150 |
| D3-NMeFOSA | | 69 | 20-150 |
| D3-NMeFOSAA | | 84 | 20-150 |
| D5-NEtFOSA | | 76 | 20-150 |
| D5-NEtFOSAA | | 83 | 20-150 |
| D7-NMeFOSE | | 93 | 20-150 |
| D9-NEtFOSE | | 92 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZD05031-030MS
Batch: 11501
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/11/2024 0844

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 9100 | 10000 | | 1 | 116 | 40-150 | 05/13/2024 2000 |
| 9Cl-PF3ONS | ND | 9000 | 11000 | | 1 | 121 | 40-150 | 05/13/2024 2000 |
| ADONA | ND | 9100 | 12000 | | 1 | 132 | 40-150 | 05/13/2024 2000 |
| 8:2FTS | ND | 9200 | 10000 | | 1 | 110 | 40-150 | 05/13/2024 2000 |
| 4:2FTS | ND | 9000 | 10000 | | 1 | 115 | 40-150 | 05/13/2024 2000 |
| 6:2FTS | ND | 9100 | 10000 | | 1 | 112 | 40-150 | 05/13/2024 2000 |
| 5:3FTCA | ND | 60000 | 73000 | | 1 | 122 | 40-150 | 05/13/2024 2000 |
| HFPO-DA | ND | 9600 | 12000 | | 1 | 128 | 40-150 | 05/13/2024 2000 |
| NEtFOSA | ND | 2400 | 2600 | | 1 | 110 | 40-150 | 05/13/2024 2000 |
| NEtFOSAA | ND | 2400 | 2600 | M-03 | 1 | 109 | 40-150 | 05/13/2024 2000 |
| NEtFOSE | ND | 24000 | 25000 | | 1 | 104 | 40-150 | 05/13/2024 2000 |
| NMeFOSA | ND | 2400 | 2500 | | 1 | 103 | 40-150 | 05/13/2024 2000 |
| NMeFOSAA | ND | 2400 | 2500 | | 1 | 102 | 40-150 | 05/13/2024 2000 |
| NMeFOSE | ND | 24000 | 25000 | | 1 | 105 | 40-150 | 05/13/2024 2000 |
| NFDHA | ND | 4800 | 6900 | | 1 | 145 | 40-150 | 05/13/2024 2000 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 4300 | 6000 | | 1 | 141 | 40-150 | 05/13/2024 2000 |
| PFMPA | ND | 4800 | 7600 | N | 1 | 159 | 40-150 | 05/13/2024 2000 |
| PFMBA | ND | 4800 | 7100 | | 1 | 149 | 40-150 | 05/13/2024 2000 |
| PFBS | 24 | 2100 | 2300 | | 1 | 108 | 40-150 | 05/13/2024 2000 |
| PFBA | 52 | 9600 | 10000 | | 1 | 106 | 40-150 | 05/13/2024 2000 |
| PFDS | ND | 2300 | 2200 | | 1 | 97 | 40-150 | 05/13/2024 2000 |
| PFDA | ND | 2400 | 2400 | | 1 | 101 | 40-150 | 05/13/2024 2000 |
| PFDoS | ND | 2300 | 2200 | | 1 | 95 | 40-150 | 05/13/2024 2000 |
| PFDoA | ND | 2400 | 2700 | | 1 | 113 | 40-150 | 05/13/2024 2000 |
| PFHpS | 150 | 2300 | 2300 | | 1 | 96 | 40-150 | 05/13/2024 2000 |
| PFHpA | 130 | 2400 | 2600 | | 1 | 103 | 40-150 | 05/13/2024 2000 |
| 7:3FTCA | ND | 60000 | 72000 | | 1 | 119 | 40-150 | 05/13/2024 2000 |
| PFHxS | 2200 | 2200 | 4300 | | 1 | 99 | 40-150 | 05/13/2024 2000 |
| PFHxA | 180 | 2400 | 2500 | | 1 | 97 | 40-150 | 05/13/2024 2000 |
| PFNS | ND | 2300 | 2400 | | 1 | 102 | 40-150 | 05/13/2024 2000 |
| PFNA | 86 | 2400 | 2500 | | 1 | 99 | 40-150 | 05/13/2024 2000 |
| PFOSA | ND | 2400 | 2400 | | 1 | 99 | 40-150 | 05/13/2024 2000 |
| PFOS | 22000 | 2200 | 26000 | NM-03 | 1 | 200 | 40-150 | 05/13/2024 2000 |
| PFOA | 300 | 2400 | 3000 | M-03 | 1 | 111 | 40-150 | 05/13/2024 2000 |
| PFPeS | 61 | 2300 | 2600 | | 1 | 111 | 40-150 | 05/13/2024 2000 |
| PFPeA | 130 | 4800 | 5200 | | 1 | 106 | 40-150 | 05/13/2024 2000 |
| 3:3FTCA | ND | 12000 | 16000 | | 1 | 132 | 40-150 | 05/13/2024 2000 |
| PFTeDA | ND | 2400 | 2500 | | 1 | 105 | 40-150 | 05/13/2024 2000 |
| PFTrDA | ND | 2400 | 2500 | | 1 | 104 | 40-150 | 05/13/2024 2000 |
| PFUnA | ND | 2400 | 2400 | | 1 | 102 | 40-150 | 05/13/2024 2000 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 78 | 20-150 |
| 13C2-6:2FTS | | 77 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZD05031-030MS
Batch: 11501
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/11/2024 0844

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 76 | 20-150 |
| 13C2-PFDoA | | 81 | 20-150 |
| 13C2-PFTeDA | | 85 | 20-150 |
| 13C3-HFPO-DA | | 92 | 20-150 |
| 13C3-PFBS | | 78 | 20-150 |
| 13C3-PFHxS | | 82 | 20-150 |
| 13C4-PFBA | | 88 | 20-150 |
| 13C4-PFHpA | | 95 | 20-150 |
| 13C5-PFHxA | | 94 | 20-150 |
| 13C5-PFPeA | | 88 | 20-150 |
| 13C6-PFDA | | 84 | 20-150 |
| 13C7-PFUnA | | 90 | 20-150 |
| 13C8-PFOA | | 83 | 20-150 |
| 13C8-PFOS | | 89 | 20-150 |
| 13C8-PFOSA | | 93 | 20-150 |
| 13C9-PFNA | | 90 | 20-150 |
| D3-NMeFOSA | | 76 | 20-150 |
| D3-NMeFOSAA | | 87 | 20-150 |
| D5-NEtFOSA | | 73 | 20-150 |
| D5-NEtFOSAA | | 88 | 20-150 |
| D7-NMeFOSE | | 91 | 20-150 |
| D9-NEtFOSE | | 91 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: ZD05031-030MD
Batch: 11501
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/11/2024 0844

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 9100 | 9800 | | 1 | 108 | 6.5 | 40-150 | 30 | 05/13/2024 2009 |
| 9Cl-PF3ONS | ND | 9000 | 11000 | | 1 | 123 | 2.0 | 40-150 | 30 | 05/13/2024 2009 |
| ADONA | ND | 9100 | 12000 | | 1 | 134 | 1.5 | 40-150 | 30 | 05/13/2024 2009 |
| 8:2FTS | ND | 9200 | 10000 | | 1 | 108 | 1.1 | 40-150 | 30 | 05/13/2024 2009 |
| 4:2FTS | ND | 9000 | 9800 | | 1 | 109 | 5.5 | 40-150 | 30 | 05/13/2024 2009 |
| 6:2FTS | ND | 9100 | 8600 | | 1 | 93 | 19 | 40-150 | 30 | 05/13/2024 2009 |
| 5:3FTCA | ND | 60000 | 77000 | | 1 | 129 | 5.5 | 40-150 | 30 | 05/13/2024 2009 |
| HFPO-DA | ND | 9600 | 12000 | | 1 | 125 | 1.9 | 40-150 | 30 | 05/13/2024 2009 |
| NEtFOSA | ND | 2400 | 2400 | | 1 | 100 | 8.9 | 40-150 | 30 | 05/13/2024 2009 |
| NEtFOSAA | ND | 2400 | 2300 | | 1 | 95 | 13 | 40-150 | 30 | 05/13/2024 2009 |
| NEtFOSE | ND | 24000 | 23000 | | 1 | 98 | 6.0 | 40-150 | 30 | 05/13/2024 2009 |
| NMeFOSA | ND | 2400 | 2200 | | 1 | 94 | 9.6 | 40-150 | 30 | 05/13/2024 2009 |
| NMeFOSAA | ND | 2400 | 2400 | | 1 | 101 | 1.1 | 40-150 | 30 | 05/13/2024 2009 |
| NMeFOSE | ND | 24000 | 24000 | | 1 | 99 | 6.7 | 40-150 | 30 | 05/13/2024 2009 |
| NFDHA | ND | 4800 | 6900 | | 1 | 143 | 0.75 | 40-150 | 30 | 05/13/2024 2009 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 4300 | 6000 | | 1 | 140 | 0.71 | 40-150 | 30 | 05/13/2024 2009 |
| PFMPA | ND | 4800 | 7300 | N | 1 | 151 | 4.9 | 40-150 | 30 | 05/13/2024 2009 |
| PFMBA | ND | 4800 | 7000 | | 1 | 145 | 2.5 | 40-150 | 30 | 05/13/2024 2009 |
| PFBS | 24 | 2100 | 2200 | | 1 | 104 | 4.3 | 40-150 | 30 | 05/13/2024 2009 |
| PFBA | 52 | 9600 | 9900 | | 1 | 102 | 3.6 | 40-150 | 30 | 05/13/2024 2009 |
| PFDS | ND | 2300 | 2200 | | 1 | 95 | 1.9 | 40-150 | 30 | 05/13/2024 2009 |
| PFDA | ND | 2400 | 2300 | | 1 | 98 | 3.1 | 40-150 | 30 | 05/13/2024 2009 |
| PFDoS | ND | 2300 | 2200 | | 1 | 94 | 1.2 | 40-150 | 30 | 05/13/2024 2009 |
| PFDoA | ND | 2400 | 2300 | | 1 | 97 | 15 | 40-150 | 30 | 05/13/2024 2009 |
| PFHpS | 150 | 2300 | 2400 | | 1 | 99 | 3.3 | 40-150 | 30 | 05/13/2024 2009 |
| PFHpA | 130 | 2400 | 2700 | | 1 | 107 | 4.1 | 40-150 | 30 | 05/13/2024 2009 |
| 7:3FTCA | ND | 60000 | 76000 | | 1 | 127 | 6.4 | 40-150 | 30 | 05/13/2024 2009 |
| PFHxS | 2200 | 2200 | 4300 | | 1 | 94 | 2.1 | 40-150 | 30 | 05/13/2024 2009 |
| PFHxA | 180 | 2400 | 2500 | | 1 | 96 | 1.2 | 40-150 | 30 | 05/13/2024 2009 |
| PFNS | ND | 2300 | 2500 | | 1 | 106 | 3.9 | 40-150 | 30 | 05/13/2024 2009 |
| PFNA | 86 | 2400 | 2500 | | 1 | 99 | 0.24 | 40-150 | 30 | 05/13/2024 2009 |
| PFOSA | ND | 2400 | 2300 | | 1 | 97 | 1.8 | 40-150 | 30 | 05/13/2024 2009 |
| PFOS | 22000 | 2200 | 25000 | NM-03 | 1 | 167 | 2.9 | 40-150 | 30 | 05/13/2024 2009 |
| PFOA | 300 | 2400 | 2900 | M-03 | 1 | 106 | 4.2 | 40-150 | 30 | 05/13/2024 2009 |
| PFPeS | 61 | 2300 | 2400 | | 1 | 105 | 6.2 | 40-150 | 30 | 05/13/2024 2009 |
| PFPeA | 130 | 4800 | 5000 | | 1 | 102 | 4.2 | 40-150 | 30 | 05/13/2024 2009 |
| 3:3FTCA | ND | 12000 | 16000 | | 1 | 137 | 3.3 | 40-150 | 30 | 05/13/2024 2009 |
| PFTeDA | ND | 2400 | 2600 | | 1 | 107 | 2.5 | 40-150 | 30 | 05/13/2024 2009 |
| PFTrDA | ND | 2400 | 2400 | | 1 | 102 | 1.7 | 40-150 | 30 | 05/13/2024 2009 |
| PFUnA | ND | 2400 | 2300 | | 1 | 97 | 4.7 | 40-150 | 30 | 05/13/2024 2009 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 90 | 20-150 |
| 13C2-6:2FTS | | 99 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: ZD05031-030MD
Batch: 11501
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 05/11/2024 0844

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 87 | 20-150 |
| 13C2-PFDoA | | 86 | 20-150 |
| 13C2-PFTeDA | | 79 | 20-150 |
| 13C3-HFPO-DA | | 87 | 20-150 |
| 13C3-PFBS | | 89 | 20-150 |
| 13C3-PFHxS | | 89 | 20-150 |
| 13C4-PFBA | | 91 | 20-150 |
| 13C4-PFHpA | | 85 | 20-150 |
| 13C5-PFHxA | | 92 | 20-150 |
| 13C5-PFPeA | | 92 | 20-150 |
| 13C6-PFDA | | 90 | 20-150 |
| 13C7-PFUnA | | 90 | 20-150 |
| 13C8-PFOA | | 87 | 20-150 |
| 13C8-PFOS | | 88 | 20-150 |
| 13C8-PFOSA | | 99 | 20-150 |
| 13C9-PFNA | | 92 | 20-150 |
| D3-NMeFOSA | | 82 | 20-150 |
| D3-NMeFOSAA | | 89 | 20-150 |
| D5-NEtFOSA | | 80 | 20-150 |
| D5-NEtFOSAA | | 90 | 20-150 |
| D7-NMeFOSE | | 95 | 20-150 |
| D9-NEtFOSE | | 94 | 20-150 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# Chain of Custody
# and
# Miscellaneous Documents

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 153987

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Jesse.Wright@arcadis.com; Cameron.Stewart@arcadis.com | Telephone No. / E-mail: 317-496-9248; 615-237-7485 | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x Austin Westhuis | Analysis (Attach list if more space is needed) | Page 1 of 4 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | Lot # Bar Code: ZD05031 |
| Project Name: ESTCP Vertebrae | | | |
| Project No.: 30027244.00004 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab/Composite | Matrix: Aqueous | Soil | Other Aqueous | No. of Containers by Preservative Type: Unpres. | HCl | HNO3 | H2SO4 | NaOH | Na2S2O3 | Other | PFAS-1633 | Remarks / Lot # / Sample I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMT-VRTB-01_1_04012024 | 4/1/24 | 1305 | G | X | | | 3 | | | | | | | X | |
| CMT-VRTB-01_2_04012024 | 4/1/24 | 1415 | G | X | | | 3 | | | | | | | X | |
| CMT-VRTB-01_3_04012024 | 4/1/24 | 1515 | G | X | | | 3 | | | | | | | X | |
| CMT-VRTB-01_4_04012024 | 4/1/24 | 1600 | G | X | | | 3 | | | | | | | X | |
| CMT-VRTB-01_5_04012024 | 4/1/24 | 1640 | G | X | | | 3 | | | | | | | X | |
| VRTB-L-MS_04012024 | 4/1/24 | 1740 | G | X | | | 3 | | | | | | | X | |
| VRTB-L-DE_04012024 | 4/1/24 | 1825 | G | X | | | 3 | | | | | | | X | |
| VRTB-L-FD_04012024 | 4/1/24 | 1925 | G | X | | | 3 | | | | | | | X | |
| VRTB-L-BBB_04012024 | 4/1/24 | 2005 | G | X | | | 3 | | | | | | | X | |
| VRTB-S-MS_04022024 | 4/2/24 | 1005 | G | X | | | 3 | | | | | | | X | |

Turn Around Time Required (Prior lab approval required for expedited TAT): ☑ Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client ☑ Disposal by Lab

Possible Hazard Identification: ☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | 4/4/24 | | 1. Received by: FedEx | 4/4/24 | |
| 2. Relinquished by | Date | Time | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: FedEx | 4/5/24 | 0955 | 4. Laboratory comments: [illegible] | 4/5/24 | 0955 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle): Yes / No — Ice Pack — Receipt Temp: 1.5; 2.1 °C — Temp Blank ☐ Y ☑ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

★ Level II Package Required ★

Document Number: ME033N2-01

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 153975

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Jesse.Wright@arcadis.com, Cameron.Stewart@arcadis.com | Telephone No. / E-mail: 317-496-9248, 615-227-7488 | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x [signature] | Analysis (Attach list if more space is needed) | Page 2 of 4 |
| City: Novi / State: MI / Zip Code: 48377 | Printed Name: Austin Westhuis | | |
| Project Name: ESTCP Vertebrae | | | |
| Project No.: 30027244.00004 | P.O. No. | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab/Composite | Matrix: Approved | Matrix: Other | Matrix: Air / Biogas | No of Containers by Preservative Type: Unpres. | NaOH | HNO3 | HCl | NaOH+ZnAc | H2SO4 | Field Filtered | PFAS - 1633 | Lot # Bar Code (lab use only) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-S-06_04022024 | 4/2/24 | 1110 | G | X | | | 3 | | | | | | | X | ZD05031 KES2 |
| VRTB-S-R7_04022024 | 4/2/24 | 1215 | G | X | | | 3 | | | | | | | X | |
| VRTB-S-PB_04022024 | 4/2/24 | 1330 | G | X | | | 3 | | | | | | | X | |
| VRTB-D-B1_04022024 | 4/2/24 | 1520 | G | X | | | 3 | | | | | | | X | |
| VRTB-D-S2_04022024 | 4/2/24 | 1610 | G | X | | | 3 | | | | | | | X | |
| VRTB-D-YB_04022024 | 4/2/24 | 1715 | G | X | | | 3 | | | | | | | X | |
| VRTB-D-GH_04022024 | 4/2/24 | 1805 | G | X | | | 3 | | | | | | | X | |
| VRTB-D-M5_04032024 | 4/3/24 | 1230 | G | X | | | 3 | | | | | | | X | |
| VRTB-D-06_04032024 | 4/3/24 | 1320 | G | X | | | 3 | | | | | | | X | |
| VRTB-D-R7_04032024 | 4/3/24 | 1420 | G | X | | | 3 | | | | | | | X | |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify)

**Sample Disposal**: ☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification**: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | | | | | |
|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | Date: 4/4/24 | Time: | 1. Received by: FedEx | Date: | Time: |
| 2. Relinquished by | Date: | Time: | 2. Received by | Date: | Time: |
| 3. Relinquished by | Date: | Time: | 3. Received by | Date: | Time: |
| 4. Relinquished by: FedEx | Date: 4/5/24 | Time: 0950 | 4. Laboratory Received by: [signature] | Date: 4/5/24 | Time: 0955 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on Ice (Circle): Yes / No — Ice Pack: — Receipt Temp.: 1.5; 2.1 °C — Temp Blank: ☐ Y ☑ N

**DISTRIBUTION:** WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy ★ Level II Package Required ★

Document Number: ME003N2-01



PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

**PACE ANALYTICAL SERVICES, LLC**
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 153976

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Jesse.Wright@arcadis.com; Cameron.Stewart@arcadis.com | Telephone No. / E-mail: 317-456-9266; 618-237-7456 | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x | Analysis (Attach list if more space is needed) | Page 3 of 4 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | Lot # Bar Code: ZD05031 |
| Project Name: ESTCP Vertebrae | | | |

| Project No. 30072244.00004 | P.O. No. | | Grab/Comp | Matrix | | | No of Containers by Preservative Type | | | | | | | PFAS - 1633 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | G=Grab C=Composite | Aqueous | Solid | Non-Aqueous | Unpres. | H2SO4 | HNO3 | HCl | NaOH | Na2S2O3 | Methanol | | | | | | | | | |
| VRTB-D-P8_04032024 | 4/3/24 | 1525 | G | X | | | 3 | | | | | | | X | | | | | | | | |
| VRTB-S-B1_04032024 | 4/3/24 | 1620 | G | X | | | 3 | | | | | | | X | | | | | | | | |
| VRTB-S-S2_04032024 | 4/3/24 | 1725 | G | X | | | 3 | | | | | | | X | | | | | | | | |
| VRTB-S-Y3_04032024 | 4/3/24 | 1830 | G | X | | | 3 | | | | | | | X | | | | | | | | |
| VRTB-S-G4_04032024 | 4/3/24 | 1920 | G | X | | | 3 | | | | | | | X | | | | | | | | |
| VRTB-L-B1_04042024 | 4/4/24 | 0935 | G | X | | | 3 | | | | | | | X | | | | | | | | |
| VRTB-L-S2_04042024 | 4/4/24 | 1015 | G | X | | | 9 | | | | | | | X | | | | | | | | MS/MSD |
| VRTB-L-Y3_04042024 | 4/4/24 | 1105 | G | X | | | 3 | | | | | | | X | | | | | | | | |
| VRTB-L-G4_04042024 | 4/4/24 | 1145 | G | X | | | 3 | | | | | | | X | | | | | | | | |
| DUP-01_04022024 | 4/2/24 | — | G | X | | | 3 | | | | | | | X | | | | | | | | |

**Turn Around Time Required (Prior lab approval required for expedited TAT.)** X Standard ☐ Rush (Specify)

**Sample Disposal** ☐ Return to Client ☒ Disposal by Lab

**Possible Hazard Identification** ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | | | | | |
|---|---|---|---|---|---|
| 1. Relinquished by: Austin Westhuis / Arcadis | Date: 4/4/24 | Time | 1. Received by: FedEx | Date: 4/4/24 | Time |
| 2. Relinquished by | Date | Time | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: FedEx | Date: 4/5/24 | Time: 0950 | 4. Laboratory Received by: [illegible] | Date: 4/5/24 | Time: 0950 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle) Yes / No Ice Pack — Receipt Temp: 1.9; 2.1 °C — Temp Blank ☐ Y ☐ N

**DISTRIBUTION:** WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy ★ Level II Package Required ★ 2.3°C Document Number: ME033N2-01

**PACE ANALYTICAL SERVICES, LLC**
105 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

**Number** 153985

| | | | |
|---|---|---|---|
| Client: Arcadis | Report to Contact: Jesse.Wright@arcadis.com Cameron.Stewart@arcadis.com | Telephone No. / E-mail: | Quote No. |
| Address: 28550 Cabot Drive, Suite 500 | Sampler's Signature: x [signature] | Analysis (Attach list if more space is needed): PFAS - 1633 | Page 4 of 4 |
| City: Novi; State: MI; Zip Code: 48377 | Printed Name: Austin Westhuis | | Lot # Bar Code: ZD05031 KE62 |
| Project Name: ESTCP Vertebrae | | | |
| Project No.: 30027244.00004 | P.O. No.: | | |

| Sample ID / Description (Containers for each sample may be combined on one line.) | Collection Date(s) | Collection Time (Military) | Grab/Composite | Matrix: Aqueous | Matrix: Solid | Matrix: Non-Aqueous | No of Containers by Preservative Type: Unpres. | HNO3 | H2SO4 | HCl | NaOH | NaS2O3 | Field reading | PFAS - 1633 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DUP-02_04042024 | 4/4/24 | — | G | X | | | 3 | | | | | | | X |

**Turn Around Time Required** (Prior lab approval required for expedited TAT.): ☑ Standard ☐ Rush (Specify)

**Sample Disposal**: ☐ Return to Client ☑ Disposal by Lab

**Possible Hazard Identification**: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

**QC Requirements (Specify)**

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished by: [signature] / Austin Westhuis / Arcadis | 4/4/24 | | 1. Received by: FedEx | 4/4/24 | |
| 2. Relinquished by | Date | Time | 2. Received by | Date | Time |
| 3. Relinquished by | Date | Time | 3. Received by | Date | Time |
| 4. Relinquished by: FedEX | Date: 4/5/24 | Time: 0955 | 4. Laboratory received by: [signature] | Date: 4/5/24 | Time: 0955 |

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle): Yes / No — Ice Pack — Receipt Temp: 1.9 °C — Temp Blank: ☐ Y ☒ N

**DISTRIBUTION:** WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

★ Level II Package Required ★

Document Number: ME003N2-01



PACE ANALYTICAL SERVICES, LLC

DC#_Title: ENV-FRM-WCOL-0286 v02_Samples Receipt Checklist (SRC)
Effective Date: 8/2/2022

# Sample Receipt Checklist (SRC)

Client: Arcadis  Cooler Inspected by/date: BRB, 4/9/24  Lot #: ZD05031

| | | | |
|---|---|---|---|
| Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: | | | |
| ☑ Yes | ☐ No | | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No | ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA
Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: NA
1.5 / 1.5 °C  2.1 / 2.1 °C  2.3 / 2.3 °C  NA / NA °C
Method: ☐ Temperature Blank ☑ Against Bottles  IR Gun ID: 8  IR Gun Correction Factor: 0 °C
Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | ☐ NA | 3. Were all coolers received at or below 6.0°C? If no, was Project Manager notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 7. Was collection date & time listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 8. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 9. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 10. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 11. Was adequate sample volume available? |
| ☑ Yes | ☐ No | | 12. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☑ Yes | ☐ No | | 13. Were all samples containers accounted for? (No missing/excess) |
| ☐ Yes | ☐ No | ☑ NA | 14. Were VOA, 8015C and RSK-175 samples free of bubbles >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 15. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 16. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☑ Yes | ☐ No | ☐ NA | 18. Was the quote number listed on the container label? If yes, Quote # 22514 |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: $H_2SO_4$, $HNO_3$, HCl, NaOH using SR # NA. ☐
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Unique ID: NA.

Comments:

Qualtrax ID: 56360  Pace® Analytical Services, LLC  Page 1 of 1

# Performance Monitoring Event #8

# Report of Analysis

**Arcadis U.S., Inc.**
9954 Mayland Drive
Richmond, VA 23233
Attention: Cameron Stewart

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Lot Number:**ZG19017**

Date Completed:08/30/2024

08/31/2024 1:29 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

## Case Narrative
## Arcadis U.S., Inc.
### Lot Number: ZG19017

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.
Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.4 has been followed for these samples, and specifically Table B-24 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples were compliant with DOD QSM 5.4 table B-24 and our PFAS SOP. Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). The CF is calculated as follows:

CF = DF * FV / Vo
FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

$C_s$ is on column concentration of target analyte in the sample (ng/L)
$C_{is}$ is concentration of internal standard in the sample (ng/L)
$A_s$ is peak response of target analyte in the sample
$A_{is}$ is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a DoD/DOE accredited laboratory; however, the following analyses are currently not listed on our DoD/DOE scope of accreditation: Drinking Water: pH EPA 150.1, Turbidity EPA 180.1, Metals EPA 200.7 & 200.8, Mercury EPA 245.1, Anions EPA 300.0, Cyanide EPA 335.4, Nitrates EPA 353.2, Orthophosphate & Phosphorus EPA 365.1, EDB/DBCP EPA 504.1, HPC SIMPLATE, Color SM 2120 B-2011, Alkalinity SM 2320 B-2011, Specific Conductance SM 2510 B-2011, Residue-filterable (TDS) SM 2540 C, Calcium Hardness (CaCO2) SM 3500-Ca B-2011, TRC SM 4500 Cl G-2011, pH SM 4500 H=B-2011, E.Coli, Total Coliform. Non-Potable Water: Metals EPA 200.7, Strontium EPA 200.8, Chlorate EPA 300.0, Cyanide EPA 335.4, Phenolics EPA 420.4, 2-Methyl-4,6-Dinitrophenol EPA 625.1, Propane RSK-

175, Specific Conductance SM 2510 B-2011, Salinity SM2520 B, Residue- total SM 2540 B, Sulfite SM 4500 SO32- B-2011, Amenable Cyanide SM 4500-CN- G-2011, BOD & CBOD SM 5210 B, MBAS SM 5540 C-2011, Boron & Titanium SW-846 6010D, Boron, Molybdenum, & Titanium SW-846 6020B, Alcohols & Glycols SW-846 8015C, Pentachlorophenol SW-846 8151A, Ethyl Acetate, Hexane, & n-Hexane SW-846 8260D, SVOC 1,4-Dioxane, 4-Dimethyl aminoazobenzene, 1,4-Naphthoquinone, 3,5-Dinitroaniline, PETN SW-846 8270E, Amenable Cyanide SW-846 9012B. Solid and Chemical Materials: Boron & Titanium SW-846 6010D, Molybdenum SW-846 6020B, Ethylene Glycol SW-846 8015B, Pentachlorophenol SW-846 8151A, Chloroprene SW-846 8260B, SVOC 1,4-Dioxane, 1,3,5-Trinitrobenzene, 1,4- Naphthoquinone, 1,4-Phenylenediamine, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 3-Methylcholanthrene, 4-Aminobiphenyl, 4-Dimethyl aminoazobenzene, 4-Nitroquinoline-1-oxide, 7,12-Dimethylbenzo(a)anthracene, Chlorobenzilate, Diallate, Ethyl methanesulfonate, Isodrin, Isosafrole, Methyl methanesulfonate, n-Nitrosomethylethylamine, n-Nitrosomorpholine, n-Nitrosopiperidine, Piperonyl butoxide, Pronamide, Safrole, 3,5- Dinitroaniline, PETN SW-846 8270E, Oil & Grease SW-846 9071B.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18. If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

Manual integration summaries are provided at the end of this report when applicable.

PFAS
Re-extraction of the following samples was performed outside of the holding time: ZG19017-015, ZG19017-016, ZG19017-020, ZG19017-022, ZG19017-023, ZG19017-024, ZG19017-025, ZG19017-027, ZG19017-028 due to PFOS being detected over calibration. All data has been reported.

Surrogate recovery for the following samples was outside control limits: ZG19017-003, ZG19017-004, ZG19017-030. Re-extraction and/or re-analysis was performed outside of holding and all data has been reported.

The method blank associated with batches 15908, 16118, 16172 had PFOS detected at a concentration that was above the MDL but below ½ the PQL. All samples associated with this method blank that have detections for PFOS have been flagged with a "B".

The method blank associated with batch 16001 had 6:2FTS, PFOS detected at a concentration that was above the MDL but below ½ the PQL. All samples associated with this method blank that have detections for 6:2FTS, PFOS have been flagged with a "B".

The LCS associated with batch 16001 had 3:3FTCA recovered above the acceptance limits. This demonstrates a high bias on analytical results. There were no detections for this compound in the samples associated with this batch; therefore, data quality is not impacted.

The LCS associated with batch 16518 had NEtFOSAA recovered above the acceptance limits. This demonstrates a high bias on analytical results. There were no detections for this compound in the samples associated with this batch; therefore, data quality is not impacted.

The LCS associated with batch 16603 had PFNA recovered below the acceptance limits. This demonstrates a low bias on analytical results. Results for this compound in the samples associated with this batch should be considered estimated.

The MS/MSD associated with sample ZG19017-018 had compounds recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

# Sample Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

| Sample Number | Sample ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| 001 | VRTB-D-M5_07152024 | Aqueous | 07/15/2024 1325 | 07/19/2024 |
| 002 | VRTB-D-06_07152024 | Aqueous | 07/15/2024 1440 | 07/19/2024 |
| 003 | VRTB-D-R7_07152024 | Aqueous | 07/15/2024 1535 | 07/19/2024 |
| 004 | VRTB-D-P8_07152024 | Aqueous | 07/15/2024 1625 | 07/19/2024 |
| 005 | VRTB-S-B1_07152024 | Aqueous | 07/15/2024 1720 | 07/19/2024 |
| 006 | VRTB-S-S2_07152024 | Aqueous | 07/15/2024 1810 | 07/19/2024 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | 07/15/2024 1910 | 07/19/2024 |
| 008 | VRTB-S-G4_07152024 | Aqueous | 07/15/2024 1955 | 07/19/2024 |
| 009 | VRTB-D-B1_07162024 | Aqueous | 07/16/2024 1105 | 07/19/2024 |
| 010 | VRTB-D-S2_07162024 | Aqueous | 07/16/2024 1150 | 07/19/2024 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | 07/16/2024 1255 | 07/19/2024 |
| 012 | VRTB-D-G4_07162024 | Aqueous | 07/16/2024 1355 | 07/19/2024 |
| 013 | VRTB-S-M5_07162024 | Aqueous | 07/16/2024 1505 | 07/19/2024 |
| 014 | VRTB-S-06_07162024 | Aqueous | 07/16/2024 1625 | 07/19/2024 |
| 015 | VRTB-S-R7_07162024 | Aqueous | 07/16/2024 1735 | 07/19/2024 |
| 016 | VRTB-S-P8_07162024 | Aqueous | 07/16/2024 1840 | 07/19/2024 |
| 017 | VRTB-L-B1_07172024 | Aqueous | 07/17/2024 1000 | 07/19/2024 |
| 018 | VRTB-L-S2_07172024 | Aqueous | 07/17/2024 1105 | 07/19/2024 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | 07/17/2024 1205 | 07/19/2024 |
| 020 | DUP-01_07162024 | Aqueous | 07/16/2024 | 07/19/2024 |
| 021 | VRTB-L-G4_07172024 | Aqueous | 07/17/2024 1305 | 07/19/2024 |
| 022 | VRTB-L-M5_07172024 | Aqueous | 07/17/2024 1435 | 07/19/2024 |
| 023 | VRTB-L-06_07172024 | Aqueous | 07/17/2024 1520 | 07/19/2024 |
| 024 | VRTB-L-P7_07172024 | Aqueous | 07/17/2024 1615 | 07/19/2024 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | 07/17/2024 1715 | 07/19/2024 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | 07/18/2024 0915 | 07/19/2024 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | 07/18/2024 1005 | 07/19/2024 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | 07/18/2024 1040 | 07/19/2024 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | 07/18/2024 1120 | 07/19/2024 |
| 030 | DUP-02_07172024 | Aqueous | 07/17/2024 | 07/19/2024 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | 07/18/2024 1155 | 07/19/2024 |

(31 samples)

# Detection Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 001 | VRTB-D-M5_07152024 | Aqueous | PFBS | 1633 | 2.4 | M-03 | ng/L | 18 |
| 001 | VRTB-D-M5_07152024 | Aqueous | PFBA | 1633 | 8.7 | M-03 | ng/L | 18 |
| 001 | VRTB-D-M5_07152024 | Aqueous | PFHpS | 1633 | 3.5 | | ng/L | 18 |
| 001 | VRTB-D-M5_07152024 | Aqueous | PFHpA | 1633 | 5.8 | | ng/L | 18 |
| 001 | VRTB-D-M5_07152024 | Aqueous | PFHxS | 1633 | 61 | | ng/L | 18 |
| 001 | VRTB-D-M5_07152024 | Aqueous | PFHxA | 1633 | 12 | | ng/L | 18 |
| 001 | VRTB-D-M5_07152024 | Aqueous | PFNA | 1633 | 1.1 | M-03 | ng/L | 18 |
| 001 | VRTB-D-M5_07152024 | Aqueous | PFOS | 1633 | 230 | M-03 | ng/L | 18 |
| 001 | VRTB-D-M5_07152024 | Aqueous | PFOA | 1633 | 6.6 | M-03 | ng/L | 18 |
| 001 | VRTB-D-M5_07152024 | Aqueous | PFPeS | 1633 | 2.9 | | ng/L | 18 |
| 001 | VRTB-D-M5_07152024 | Aqueous | PFPeA | 1633 | 13 | | ng/L | 18 |
| 002 | VRTB-D-06_07152024 | Aqueous | PFBS | 1633 | 2.3 | M-03 | ng/L | 20 |
| 002 | VRTB-D-06_07152024 | Aqueous | PFBA | 1633 | 8.2 | M-03 | ng/L | 20 |
| 002 | VRTB-D-06_07152024 | Aqueous | PFHpS | 1633 | 6.6 | M-03 | ng/L | 20 |
| 002 | VRTB-D-06_07152024 | Aqueous | PFHpA | 1633 | 7.8 | | ng/L | 20 |
| 002 | VRTB-D-06_07152024 | Aqueous | PFHxS | 1633 | 88 | | ng/L | 20 |
| 002 | VRTB-D-06_07152024 | Aqueous | PFHxA | 1633 | 13 | | ng/L | 20 |
| 002 | VRTB-D-06_07152024 | Aqueous | PFNA | 1633 | 1.3 | M-03 | ng/L | 20 |
| 002 | VRTB-D-06_07152024 | Aqueous | PFOS | 1633 | 260 | M-03 | ng/L | 20 |
| 002 | VRTB-D-06_07152024 | Aqueous | PFOA | 1633 | 9.7 | M-03 | ng/L | 20 |
| 002 | VRTB-D-06_07152024 | Aqueous | PFPeS | 1633 | 4.6 | | ng/L | 20 |
| 002 | VRTB-D-06_07152024 | Aqueous | PFPeA | 1633 | 12 | M-03 | ng/L | 20 |
| 003 | VRTB-D-R7_07152024 | Aqueous | PFBS | 1633 | 5.2 | M-03 | ng/L | 22 |
| 003 | VRTB-D-R7_07152024 | Aqueous | PFBA | 1633 | 12 | M-03 | ng/L | 22 |
| 003 | VRTB-D-R7_07152024 | Aqueous | PFHpS | 1633 | 1.7 | | ng/L | 22 |
| 003 | VRTB-D-R7_07152024 | Aqueous | PFHpA | 1633 | 18 | | ng/L | 22 |
| 003 | VRTB-D-R7_07152024 | Aqueous | PFHxS | 1633 | 61 | | ng/L | 22 |
| 003 | VRTB-D-R7_07152024 | Aqueous | PFHxA | 1633 | 18 | | ng/L | 22 |
| 003 | VRTB-D-R7_07152024 | Aqueous | PFNA | 1633 | 1.2 | M-03 | ng/L | 22 |
| 003 | VRTB-D-R7_07152024 | Aqueous | PFOS | 1633 | 100 | M-03 | ng/L | 22 |
| 003 | VRTB-D-R7_07152024 | Aqueous | PFOA | 1633 | 13 | M-03 | ng/L | 22 |
| 003 | VRTB-D-R7_07152024 | Aqueous | PFPeS | 1633 | 1.9 | | ng/L | 22 |
| 003 | VRTB-D-R7_07152024 | Aqueous | PFPeA | 1633 | 20 | | ng/L | 22 |
| 004 | VRTB-D-P8_07152024 | Aqueous | PFBS | 1633 | 5.9 | M-03 | ng/L | 26 |
| 004 | VRTB-D-P8_07152024 | Aqueous | PFBA | 1633 | 12 | | ng/L | 26 |
| 004 | VRTB-D-P8_07152024 | Aqueous | PFHpS | 1633 | 4.1 | | ng/L | 26 |
| 004 | VRTB-D-P8_07152024 | Aqueous | PFHpA | 1633 | 22 | | ng/L | 26 |
| 004 | VRTB-D-P8_07152024 | Aqueous | PFHxS | 1633 | 120 | | ng/L | 26 |
| 004 | VRTB-D-P8_07152024 | Aqueous | PFHxA | 1633 | 20 | | ng/L | 26 |
| 004 | VRTB-D-P8_07152024 | Aqueous | PFNA | 1633 | 6.7 | | ng/L | 26 |
| 004 | VRTB-D-P8_07152024 | Aqueous | PFOS | 1633 | 310 | M-03 | ng/L | 26 |
| 004 | VRTB-D-P8_07152024 | Aqueous | PFOA | 1633 | 22 | M-03 | ng/L | 26 |
| 004 | VRTB-D-P8_07152024 | Aqueous | PFPeS | 1633 | 3.7 | | ng/L | 26 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 004 | VRTB-D-P8_07152024 | Aqueous | PFPeA | 1633 | 23 | M-03 | ng/L | 26 |
| 005 | VRTB-S-B1_07152024 | Aqueous | PFBS | 1633 | 3.1 | M-03 | ng/L | 30 |
| 005 | VRTB-S-B1_07152024 | Aqueous | PFBA | 1633 | 4.1 | M-03 | ng/L | 30 |
| 005 | VRTB-S-B1_07152024 | Aqueous | PFHpS | 1633 | 1.2 | M-03 | ng/L | 30 |
| 005 | VRTB-S-B1_07152024 | Aqueous | PFHpA | 1633 | 2.9 | M-03 | ng/L | 30 |
| 005 | VRTB-S-B1_07152024 | Aqueous | PFHxS | 1633 | 27 | M-03 | ng/L | 30 |
| 005 | VRTB-S-B1_07152024 | Aqueous | PFHxA | 1633 | 3.8 | M-03 | ng/L | 30 |
| 005 | VRTB-S-B1_07152024 | Aqueous | PFNA | 1633 | 0.31 | JM-03 | ng/L | 30 |
| 005 | VRTB-S-B1_07152024 | Aqueous | PFOS | 1633 | 150 | M-03 | ng/L | 30 |
| 005 | VRTB-S-B1_07152024 | Aqueous | PFOA | 1633 | 2.9 | M-03 | ng/L | 30 |
| 005 | VRTB-S-B1_07152024 | Aqueous | PFPeS | 1633 | 1.6 | M-03 | ng/L | 30 |
| 005 | VRTB-S-B1_07152024 | Aqueous | PFPeA | 1633 | 3.3 | M-03 | ng/L | 30 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFBS | 1633 | 5.2 | M-03 | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFBA | 1633 | 19 | M-03 | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFHpS | 1633 | 9.7 | M-03 | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFHpA | 1633 | 37 | | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFHxS | 1633 | 120 | | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFHxA | 1633 | 35 | | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFNS | 1633 | 0.32 | JM-03 | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFNA | 1633 | 20 | | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFOSA | 1633 | 1.2 | M-03 | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFOS | 1633 | 750 | M-03 | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFOA | 1633 | 36 | M-03 | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFPeS | 1633 | 6.9 | | ng/L | 32 |
| 006 | VRTB-S-S2_07152024 | Aqueous | PFPeA | 1633 | 31 | M-03 | ng/L | 32 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | 8:2FTS | 1633 | 1.9 | JM-03 | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFBS | 1633 | 10 | | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFBA | 1633 | 16 | | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFHpS | 1633 | 29 | | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFHpA | 1633 | 15 | | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFHxS | 1633 | 610 | M-03 | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFHxA | 1633 | 37 | | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFNS | 1633 | 0.39 | JM-03 | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFNA | 1633 | 4.9 | M-03 | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFOSA | 1633 | 1.5 | M-03 | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFOS | 1633 | 1100 | BM-03 | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFOA | 1633 | 26 | | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFPeS | 1633 | 26 | | ng/L | 34 |
| 007 | VRTB-S-Y3_07152024 | Aqueous | PFPeA | 1633 | 25 | M-03 | ng/L | 34 |
| 008 | VRTB-S-G4_07152024 | Aqueous | PFBS | 1633 | 6.4 | | ng/L | 36 |
| 008 | VRTB-S-G4_07152024 | Aqueous | PFBA | 1633 | 4.3 | M-03 | ng/L | 36 |
| 008 | VRTB-S-G4_07152024 | Aqueous | PFHpS | 1633 | 17 | | ng/L | 36 |
| 008 | VRTB-S-G4_07152024 | Aqueous | PFHpA | 1633 | 6.1 | M-03 | ng/L | 36 |
| 008 | VRTB-S-G4_07152024 | Aqueous | PFHxS | 1633 | 300 | M-03 | ng/L | 36 |
| 008 | VRTB-S-G4_07152024 | Aqueous | PFHxA | 1633 | 15 | | ng/L | 36 |
| 008 | VRTB-S-G4_07152024 | Aqueous | PFNA | 1633 | 2.2 | M-03 | ng/L | 36 |
| 008 | VRTB-S-G4_07152024 | Aqueous | PFOS | 1633 | 950 | BM-03 | ng/L | 36 |
| 008 | VRTB-S-G4_07152024 | Aqueous | PFOA | 1633 | 13 | M-03 | ng/L | 36 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 008 | VRTB-S-G4_07152024 | Aqueous | PFPeS | 1633 | 11 | | ng/L | 36 |
| 008 | VRTB-S-G4_07152024 | Aqueous | PFPeA | 1633 | 7.1 | M-03 | ng/L | 36 |
| 009 | VRTB-D-B1_07162024 | Aqueous | 8:2FTS | 1633 | 3.4 | JM-03 | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | 6:2FTS | 1633 | 8.9 | M-03 | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFBS | 1633 | 13 | M-03 | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFBA | 1633 | 17 | M-03 | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFHpS | 1633 | 34 | | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFHpA | 1633 | 28 | | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFHxS | 1633 | 460 | | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFHxA | 1633 | 37 | | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFNA | 1633 | 16 | M-03 | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFOSA | 1633 | 0.27 | J | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFOS | 1633 | 2200 | BM-03 | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFOA | 1633 | 56 | M-03 | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFPeS | 1633 | 25 | M-03 | ng/L | 38 |
| 009 | VRTB-D-B1_07162024 | Aqueous | PFPeA | 1633 | 29 | M-03 | ng/L | 38 |
| 010 | VRTB-D-S2_07162024 | Aqueous | PFBS | 1633 | 14 | | ng/L | 40 |
| 010 | VRTB-D-S2_07162024 | Aqueous | PFBA | 1633 | 5.4 | M-03 | ng/L | 40 |
| 010 | VRTB-D-S2_07162024 | Aqueous | PFHpS | 1633 | 6.8 | M-03 | ng/L | 40 |
| 010 | VRTB-D-S2_07162024 | Aqueous | PFHpA | 1633 | 6.3 | | ng/L | 40 |
| 010 | VRTB-D-S2_07162024 | Aqueous | PFHxS | 1633 | 160 | | ng/L | 40 |
| 010 | VRTB-D-S2_07162024 | Aqueous | PFHxA | 1633 | 11 | M-03 | ng/L | 40 |
| 010 | VRTB-D-S2_07162024 | Aqueous | PFNA | 1633 | 0.58 | JM-03 | ng/L | 40 |
| 010 | VRTB-D-S2_07162024 | Aqueous | PFOS | 1633 | 210 | BM-03 | ng/L | 40 |
| 010 | VRTB-D-S2_07162024 | Aqueous | PFOA | 1633 | 14 | M-03 | ng/L | 40 |
| 010 | VRTB-D-S2_07162024 | Aqueous | PFPeS | 1633 | 33 | | ng/L | 40 |
| 010 | VRTB-D-S2_07162024 | Aqueous | PFPeA | 1633 | 7.6 | M-03 | ng/L | 40 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | PFBS | 1633 | 3.2 | M-03 | ng/L | 42 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | PFBA | 1633 | 3.7 | M-03 | ng/L | 42 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | PFHpS | 1633 | 1.8 | M-03 | ng/L | 42 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | PFHpA | 1633 | 3.3 | | ng/L | 42 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | PFHxS | 1633 | 61 | | ng/L | 42 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | PFHxA | 1633 | 5.5 | M-03 | ng/L | 42 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | PFNA | 1633 | 0.31 | JM-03 | ng/L | 42 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | PFOS | 1633 | 89 | BM-03 | ng/L | 42 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | PFOA | 1633 | 4.8 | M-03 | ng/L | 42 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | PFPeS | 1633 | 7.3 | | ng/L | 42 |
| 011 | VRTB-D-Y3_07162024 | Aqueous | PFPeA | 1633 | 4.2 | M-03 | ng/L | 42 |
| 012 | VRTB-D-G4_07162024 | Aqueous | PFBS | 1633 | 0.89 | M-03 | ng/L | 44 |
| 012 | VRTB-D-G4_07162024 | Aqueous | PFBA | 1633 | 7.1 | M-03 | ng/L | 44 |
| 012 | VRTB-D-G4_07162024 | Aqueous | PFHpS | 1633 | 1.6 | M-03 | ng/L | 44 |
| 012 | VRTB-D-G4_07162024 | Aqueous | PFHpA | 1633 | 3.8 | | ng/L | 44 |
| 012 | VRTB-D-G4_07162024 | Aqueous | PFHxS | 1633 | 38 | M-03 | ng/L | 44 |
| 012 | VRTB-D-G4_07162024 | Aqueous | PFHxA | 1633 | 10 | | ng/L | 44 |
| 012 | VRTB-D-G4_07162024 | Aqueous | PFNA | 1633 | 0.48 | JM-03 | ng/L | 44 |
| 012 | VRTB-D-G4_07162024 | Aqueous | PFOS | 1633 | 120 | BM-03 | ng/L | 44 |
| 012 | VRTB-D-G4_07162024 | Aqueous | PFOA | 1633 | 3.7 | M-03 | ng/L | 44 |
| 012 | VRTB-D-G4_07162024 | Aqueous | PFPeS | 1633 | 1.5 | M-03 | ng/L | 44 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 012 | VRTB-D-G4_07162024 | Aqueous | PFPeA | 1633 | 12 | | ng/L | 44 |
| 013 | VRTB-S-M5_07162024 | Aqueous | 8:2FTS | 1633 | 47 | | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | 6:2FTS | 1633 | 44 | | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFBS | 1633 | 5.9 | M-03 | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFBA | 1633 | 23 | | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFDA | 1633 | 0.45 | JM-03 | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFHpS | 1633 | 54 | | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFHpA | 1633 | 48 | | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFHxS | 1633 | 510 | M-03 | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFHxA | 1633 | 68 | M-03 | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFNA | 1633 | 25 | M-03 | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFOSA | 1633 | 0.65 | JM-03 | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFOS | 1633 | 4600 | BM-03 | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFOA | 1633 | 70 | M-03 | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFPeS | 1633 | 13 | | ng/L | 46 |
| 013 | VRTB-S-M5_07162024 | Aqueous | PFPeA | 1633 | 52 | | ng/L | 46 |
| 014 | VRTB-S-06_07162024 | Aqueous | 8:2FTS | 1633 | 1.0 | J | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | 6:2FTS | 1633 | 3.2 | JM-03 | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFBS | 1633 | 9.1 | | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFBA | 1633 | 8.9 | M-03 | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFDA | 1633 | 1.3 | | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFHpS | 1633 | 130 | | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFHpA | 1633 | 15 | M-03 | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFHxS | 1633 | 580 | M-03 | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFHxA | 1633 | 23 | | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFNS | 1633 | 0.74 | JM-03 | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFNA | 1633 | 9.5 | M-03 | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFOSA | 1633 | 7.8 | M-03 | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFOS | 1633 | 2200 | BM-03 | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFOA | 1633 | 68 | M-03 | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFPeS | 1633 | 22 | | ng/L | 48 |
| 014 | VRTB-S-06_07162024 | Aqueous | PFPeA | 1633 | 13 | M-03 | ng/L | 48 |
| 015 | VRTB-S-R7_07162024 | Aqueous | 8:2FTS | 1633 | 66 | M-03 | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | 6:2FTS | 1633 | 90 | | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFBS | 1633 | 29 | | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFBA | 1633 | 39 | | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFDA | 1633 | 0.36 | JM-03 | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFHpS | 1633 | 300 | | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFHpA | 1633 | 90 | | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFHxA | 1633 | 210 | M-03 | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFNS | 1633 | 1.5 | M-03 | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFNA | 1633 | 100 | M-03 | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFOSA | 1633 | 5.4 | M-03 | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFOA | 1633 | 220 | M-03 | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFPeS | 1633 | 75 | | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFPeA | 1633 | 88 | M-03 | ng/L | 50 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFHxS | 1633 | 2200 | M-03 | ng/L | 52 |
| 015 | VRTB-S-R7_07162024 | Aqueous | PFOS | 1633 | 23000 | HM-03 | ng/L | 54 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 016 | VRTB-S-P8_07162024 | Aqueous | 8:2FTS | 1633 | 16 | | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | 6:2FTS | 1633 | 35 | | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFBS | 1633 | 31 | M-03 | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFBA | 1633 | 22 | M-03 | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFHpS | 1633 | 180 | | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFHpA | 1633 | 37 | | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFHxA | 1633 | 110 | | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFNS | 1633 | 0.57 | JM-03 | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFNA | 1633 | 41 | M-03 | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFOSA | 1633 | 2.5 | M-03 | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFOA | 1633 | 100 | | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFPeS | 1633 | 48 | | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFPeA | 1633 | 41 | | ng/L | 56 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFHxS | 1633 | 1000 | M-03 | ng/L | 58 |
| 016 | VRTB-S-P8_07162024 | Aqueous | PFOS | 1633 | 11000 | HM-03 | ng/L | 60 |
| 017 | VRTB-L-B1_07172024 | Aqueous | 8:2FTS | 1633 | 47 | | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | 6:2FTS | 1633 | 14 | M-03 | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFBS | 1633 | 5.1 | | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFBA | 1633 | 13 | M-03 | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFDA | 1633 | 0.39 | JM-03 | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFHpS | 1633 | 28 | | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFHpA | 1633 | 25 | | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFHxS | 1633 | 210 | | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFHxA | 1633 | 28 | | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFNS | 1633 | 0.13 | JM-03 | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFNA | 1633 | 15 | M-03 | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFOSA | 1633 | 1.8 | M-03 | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFOS | 1633 | 2700 | BM-03 | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFOA | 1633 | 40 | M-03 | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFPeS | 1633 | 8.3 | | ng/L | 62 |
| 017 | VRTB-L-B1_07172024 | Aqueous | PFPeA | 1633 | 23 | M-03 | ng/L | 62 |
| 018 | VRTB-L-S2_07172024 | Aqueous | 8:2FTS | 1633 | 5.7 | M-03 | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | 6:2FTS | 1633 | 2.5 | JM-03 | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFBS | 1633 | 6.0 | M-03 | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFBA | 1633 | 8.1 | M-03 | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFHpS | 1633 | 12 | | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFHpA | 1633 | 9.2 | | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFHxS | 1633 | 150 | M-03 | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFHxA | 1633 | 14 | | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFNA | 1633 | 3.6 | M-03 | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFOSA | 1633 | 1.1 | M-03 | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFOS | 1633 | 700 | BM-03 | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFOA | 1633 | 23 | M-03 | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFPeS | 1633 | 9.2 | M-03 | ng/L | 64 |
| 018 | VRTB-L-S2_07172024 | Aqueous | PFPeA | 1633 | 10 | M-03 | ng/L | 64 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | 8:2FTS | 1633 | 41 | M-03 | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | 6:2FTS | 1633 | 5.6 | M-03 | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFBS | 1633 | 4.7 | M-03 | ng/L | 66 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFBA | 1633 | 8.4 | | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFHpS | 1633 | 13 | | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFHpA | 1633 | 13 | | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFHxS | 1633 | 120 | | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFHxA | 1633 | 14 | M-03 | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFNS | 1633 | 0.31 | JM-03 | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFNA | 1633 | 4.8 | M-03 | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFOSA | 1633 | 3.0 | M-03 | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFOS | 1633 | 990 | BM-03 | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFOA | 1633 | 22 | M-03 | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFPeS | 1633 | 7.1 | M-03 | ng/L | 66 |
| 019 | VRTB-L-Y3_07172024 | Aqueous | PFPeA | 1633 | 12 | | ng/L | 66 |
| 020 | DUP-01_07162024 | Aqueous | 8:2FTS | 1633 | 69 | M-03 | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | 6:2FTS | 1633 | 82 | | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFBS | 1633 | 30 | | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFBA | 1633 | 39 | M-03 | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFDA | 1633 | 0.52 | JM-03 | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFHpS | 1633 | 310 | | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFHpA | 1633 | 94 | | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFHxA | 1633 | 210 | | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFNS | 1633 | 1.4 | M-03 | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFNA | 1633 | 94 | M-03 | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFOSA | 1633 | 5.5 | M-03 | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFOA | 1633 | 220 | M-03 | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFPeS | 1633 | 75 | | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFPeA | 1633 | 88 | M-03 | ng/L | 68 |
| 020 | DUP-01_07162024 | Aqueous | PFHxS | 1633 | 2100 | M-03 | ng/L | 70 |
| 020 | DUP-01_07162024 | Aqueous | PFOS | 1633 | 20000 | HM-03 | ng/L | 72 |
| 021 | VRTB-L-G4_07172024 | Aqueous | 8:2FTS | 1633 | 1.6 | JM-03 | ng/L | 74 |
| 021 | VRTB-L-G4_07172024 | Aqueous | PFBS | 1633 | 5.9 | M-03 | ng/L | 74 |
| 021 | VRTB-L-G4_07172024 | Aqueous | PFBA | 1633 | 6.9 | | ng/L | 74 |
| 021 | VRTB-L-G4_07172024 | Aqueous | PFHpS | 1633 | 9.3 | | ng/L | 74 |
| 021 | VRTB-L-G4_07172024 | Aqueous | PFHpA | 1633 | 7.0 | M-03 | ng/L | 74 |
| 021 | VRTB-L-G4_07172024 | Aqueous | PFHxS | 1633 | 130 | | ng/L | 74 |
| 021 | VRTB-L-G4_07172024 | Aqueous | PFHxA | 1633 | 12 | | ng/L | 74 |
| 021 | VRTB-L-G4_07172024 | Aqueous | PFNA | 1633 | 2.6 | M-03 | ng/L | 74 |
| 021 | VRTB-L-G4_07172024 | Aqueous | PFOS | 1633 | 440 | BM-03 | ng/L | 74 |
| 021 | VRTB-L-G4_07172024 | Aqueous | PFOA | 1633 | 17 | M-03 | ng/L | 74 |
| 021 | VRTB-L-G4_07172024 | Aqueous | PFPeS | 1633 | 9.0 | | ng/L | 74 |
| 021 | VRTB-L-G4_07172024 | Aqueous | PFPeA | 1633 | 8.8 | M-03 | ng/L | 74 |
| 022 | VRTB-L-M5_07172024 | Aqueous | 8:2FTS | 1633 | 45 | | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | 6:2FTS | 1633 | 58 | | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFBS | 1633 | 4.3 | | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFBA | 1633 | 25 | | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFDA | 1633 | 0.56 | JM-03 | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFHpS | 1633 | 85 | | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFHpA | 1633 | 61 | | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFHxS | 1633 | 490 | | ng/L | 76 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 022 | VRTB-L-M5_07172024 | Aqueous | PFHxA | 1633 | 53 | | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFNS | 1633 | 0.52 | JM-03 | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFNA | 1633 | 82 | | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFOSA | 1633 | 1.2 | M-03 | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFOA | 1633 | 100 | M-03 | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFPeS | 1633 | 9.9 | | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFPeA | 1633 | 58 | | ng/L | 76 |
| 022 | VRTB-L-M5_07172024 | Aqueous | PFOS | 1633 | 10000 | HM-03 | ng/L | 78 |
| 023 | VRTB-L-06_07172024 | Aqueous | 8:2FTS | 1633 | 90 | | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | 6:2FTS | 1633 | 160 | | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFBS | 1633 | 6.6 | M-03 | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFBA | 1633 | 37 | M-03 | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFHpS | 1633 | 140 | | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFHpA | 1633 | 100 | | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFHxA | 1633 | 120 | | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFNS | 1633 | 0.58 | JM-10 | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFNA | 1633 | 110 | | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFOA | 1633 | 170 | M-03 | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFPeS | 1633 | 22 | | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFPeA | 1633 | 100 | | ng/L | 80 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFHxS | 1633 | 1000 | M-03 | ng/L | 82 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFOSA | 1633 | 1.7 | JM-03 | ng/L | 82 |
| 023 | VRTB-L-06_07172024 | Aqueous | PFOS | 1633 | 17000 | HM-03 | ng/L | 84 |
| 024 | VRTB-L-P7_07172024 | Aqueous | 8:2FTS | 1633 | 47 | M-03 | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | 6:2FTS | 1633 | 140 | | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFBS | 1633 | 10 | | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFBA | 1633 | 54 | M-03 | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFDA | 1633 | 0.74 | JM-03 | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFHpS | 1633 | 160 | | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFHpA | 1633 | 160 | | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFHxA | 1633 | 170 | | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFNS | 1633 | 0.49 | JM-03 | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFNA | 1633 | 87 | | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFOA | 1633 | 240 | M-03 | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFPeS | 1633 | 35 | | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFPeA | 1633 | 150 | | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | 3:3FTCA | 1633 | 1.1 | JM-03 | ng/L | 86 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFHxS | 1633 | 1500 | M-03 | ng/L | 88 |
| 024 | VRTB-L-P7_07172024 | Aqueous | PFOS | 1633 | 15000 | HM-03 | ng/L | 90 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | 8:2FTS | 1633 | 34 | | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | 6:2FTS | 1633 | 230 | | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFBS | 1633 | 24 | | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFBA | 1633 | 49 | M-03 | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFDA | 1633 | 0.64 | JM-03 | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFHpS | 1633 | 390 | | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFHpA | 1633 | 200 | | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFHxA | 1633 | 270 | | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFNS | 1633 | 0.48 | JM-03 | ng/L | 92 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFNA | 1633 | 140 | M-03 | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFOA | 1633 | 390 | M-03 | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFPeS | 1633 | 100 | M-03 | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFPeA | 1633 | 160 | | ng/L | 92 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFHxS | 1633 | 2800 | M-03 | ng/L | 94 |
| 025 | VRTB-L-BB8_07172024 | Aqueous | PFOS | 1633 | 17000 | HM-03 | ng/L | 96 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFBS | 1633 | 21 | | ng/L | 98 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFBA | 1633 | 31 | | ng/L | 98 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFHpS | 1633 | 8.0 | M-03 | ng/L | 98 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFHpA | 1633 | 130 | | ng/L | 98 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFHxS | 1633 | 150 | | ng/L | 98 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFHxA | 1633 | 75 | | ng/L | 98 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFNA | 1633 | 4.0 | M-03 | ng/L | 98 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFOSA | 1633 | 0.25 | JM-03 | ng/L | 98 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFOS | 1633 | 560 | M-03 | ng/L | 98 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFOA | 1633 | 250 | M-03 | ng/L | 98 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFPeS | 1633 | 6.5 | | ng/L | 98 |
| 026 | CMT-VRTB-01_1_07182024 | Aqueous | PFPeA | 1633 | 75 | | ng/L | 98 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | 8:2FTS | 1633 | 59 | | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | 6:2FTS | 1633 | 91 | | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFBS | 1633 | 30 | | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFBA | 1633 | 30 | | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFDA | 1633 | 0.49 | JM-03 | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFHpS | 1633 | 490 | | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFHpA | 1633 | 67 | | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFHxA | 1633 | 180 | | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFNS | 1633 | 1.4 | M-03 | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFNA | 1633 | 120 | M-03 | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFOA | 1633 | 190 | M-03 | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFPeS | 1633 | 81 | | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFPeA | 1633 | 65 | | ng/L | 100 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFHxS | 1633 | 2200 | M-03 | ng/L | 102 |
| 027 | CMT-VRTB-01_2_07182024 | Aqueous | PFOS | 1633 | 37000 | HM-03 | ng/L | 104 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | 8:2FTS | 1633 | 16 | | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | 6:2FTS | 1633 | 16 | | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFBS | 1633 | 8.0 | M-03 | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFBA | 1633 | 16 | | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFHpS | 1633 | 39 | | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFHpA | 1633 | 30 | | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFHxS | 1633 | 380 | | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFHxA | 1633 | 35 | | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFNA | 1633 | 31 | M-03 | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFOSA | 1633 | 0.61 | JM-03 | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFOA | 1633 | 49 | M-03 | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFPeS | 1633 | 13 | | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFPeA | 1633 | 27 | | ng/L | 106 |
| 028 | CMT-VRTB-01_3_07182024 | Aqueous | PFOS | 1633 | 5100 | HM-03 | ng/L | 108 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | 8:2FTS | 1633 | 0.87 | JM-03 | ng/L | 110 |

| Sample | Sample ID | Matrix | Parameter | Method | Result | Q | Units | Page |
|---|---|---|---|---|---|---|---|---|
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | 6:2FTS | 1633 | 8.7 | | ng/L | 110 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | PFBS | 1633 | 7.4 | | ng/L | 110 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | PFBA | 1633 | 10 | | ng/L | 110 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | PFHpS | 1633 | 18 | | ng/L | 110 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | PFHpA | 1633 | 15 | | ng/L | 110 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | PFHxS | 1633 | 220 | M-03 | ng/L | 110 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | PFHxA | 1633 | 19 | | ng/L | 110 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | PFNA | 1633 | 13 | M-03 | ng/L | 110 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | PFOS | 1633 | 1600 | BM-03 | ng/L | 110 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | PFOA | 1633 | 28 | | ng/L | 110 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | PFPeS | 1633 | 11 | | ng/L | 110 |
| 029 | CMT-VRTB-01_4_07182024 | Aqueous | PFPeA | 1633 | 15 | | ng/L | 110 |
| 030 | DUP-02_07172024 | Aqueous | 8:2FTS | 1633 | 1.6 | JM-03 | ng/L | 112 |
| 030 | DUP-02_07172024 | Aqueous | PFBS | 1633 | 5.2 | | ng/L | 112 |
| 030 | DUP-02_07172024 | Aqueous | PFBA | 1633 | 6.6 | | ng/L | 112 |
| 030 | DUP-02_07172024 | Aqueous | PFHpS | 1633 | 9.2 | M-03 | ng/L | 112 |
| 030 | DUP-02_07172024 | Aqueous | PFHpA | 1633 | 6.8 | | ng/L | 112 |
| 030 | DUP-02_07172024 | Aqueous | PFHxS | 1633 | 120 | M-03 | ng/L | 112 |
| 030 | DUP-02_07172024 | Aqueous | PFHxA | 1633 | 11 | | ng/L | 112 |
| 030 | DUP-02_07172024 | Aqueous | PFNA | 1633 | 2.8 | M-03 | ng/L | 112 |
| 030 | DUP-02_07172024 | Aqueous | PFOS | 1633 | 460 | BM-03 | ng/L | 112 |
| 030 | DUP-02_07172024 | Aqueous | PFOA | 1633 | 17 | M-03 | ng/L | 112 |
| 030 | DUP-02_07172024 | Aqueous | PFPeS | 1633 | 9.5 | M-03 | ng/L | 112 |
| 030 | DUP-02_07172024 | Aqueous | PFPeA | 1633 | 8.8 | M-03 | ng/L | 112 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | PFBS | 1633 | 9.2 | M-03 | ng/L | 116 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | PFBA | 1633 | 10 | | ng/L | 116 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | PFHpS | 1633 | 8.0 | | ng/L | 116 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | PFHpA | 1633 | 11 | | ng/L | 116 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | PFHxS | 1633 | 160 | M-03 | ng/L | 116 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | PFHxA | 1633 | 17 | | ng/L | 116 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | PFNA | 1633 | 2.2 | M-03 | ng/L | 116 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | PFOS | 1633 | 310 | BM-03 | ng/L | 116 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | PFOA | 1633 | 20 | M-03 | ng/L | 116 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | PFPeS | 1633 | 12 | | ng/L | 116 |
| 031 | CMT-VRTB-01_5_07182024 | Aqueous | PFPeA | 1633 | 13 | | ng/L | 116 |

(414 detections)

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-001
Description: VRTB-D-M5_07152024 | Matrix: Aqueous
Date Sampled: 07/15/2024 1325 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/19/2024 2358 | BWS | 08/09/2024 1707 | 15907 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.82 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.7 | 2.0 | 0.62 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.7 | 2.1 | 0.62 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.7 | 1.4 | 0.37 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.3 | U | 4.7 | 4.3 | 1.9 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 4.0 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.7 | 2.2 | 0.93 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.57 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.9 | U | 9.3 | 1.9 | 0.59 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.54 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 1.0 | U | 1.9 | 1.0 | 0.34 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.61 | U | 1.9 | 0.61 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.9 | 1.2 | 0.36 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 2.4 | M-03 | 0.93 | 0.33 | 0.087 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.7 | M-03 | 3.7 | 1.5 | 0.48 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.36 | U | 0.93 | 0.36 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.10 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 3.5 | | 0.93 | 0.35 | 0.18 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 5.8 | | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 61 | | 0.93 | 0.68 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 12 | | 0.93 | 0.37 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.35 | U | 0.93 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.1 | M-03 | 0.93 | 0.37 | 0.096 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.19 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 230 | M-03 | 0.93 | 0.69 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 6.6 | M-03 | 0.93 | 0.74 | 0.20 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 2.9 | | 0.93 | 0.70 | 0.24 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 13 | | 1.9 | 0.38 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.9 | U | 4.7 | 1.9 | 0.56 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.25 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.37 | U | 0.93 | 0.37 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.74 | U | 0.93 | 0.74 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-001
Description: VRTB-D-M5_07152024
Matrix: Aqueous
Date Sampled: 07/15/2024 1325
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 91 | 40-200 |
| 13C2-6:2FTS | | 96 | 40-200 |
| 13C2-8:2FTS | M-03 | 87 | 40-300 |
| 13C2-PFDoA | | 74 | 10-130 |
| 13C2-PFTeDA | | 50 | 10-130 |
| 13C3-HFPO-DA | | 94 | 40-130 |
| 13C3-PFBS | | 96 | 40-135 |
| 13C3-PFHxS | | 92 | 40-130 |
| 13C4-PFBA | | 96 | 5.0-130 |
| 13C4-PFHpA | | 99 | 40-130 |
| 13C5-PFHxA | | 99 | 40-130 |
| 13C5-PFPeA | | 99 | 40-130 |
| 13C6-PFDA | | 91 | 40-130 |
| 13C7-PFUnA | | 76 | 30-130 |
| 13C8-PFOA | | 93 | 40-130 |
| 13C8-PFOS | | 94 | 40-130 |
| 13C8-PFOSA | | 63 | 40-130 |
| 13C9-PFNA | | 95 | 40-130 |
| D3-NMeFOSA | | 45 | 10-130 |
| D3-NMeFOSAA | | 68 | 40-170 |
| D5-NEtFOSA | | 42 | 10-130 |
| D5-NEtFOSAA | | 60 | 25-135 |
| D7-NMeFOSE | | 33 | 10-130 |
| D9-NEtFOSE | | 16 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-002
Description: VRTB-D-06_07152024 | Matrix: Aqueous
Date Sampled: 07/15/2024 1440 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/20/2024 0026 | BWS | 08/09/2024 1707 | 15907 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.55 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.1 | U | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.55 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.57 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 2.3 | M-03 | 0.90 | 0.32 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.2 | M-03 | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.096 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 6.6 | M-03 | 0.90 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 7.8 | | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 88 | | 0.90 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 13 | | 0.90 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.90 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.3 | M-03 | 0.90 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 260 | M-03 | 0.90 | 0.67 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 9.7 | M-03 | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 4.6 | | 0.90 | 0.68 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 12 | M-03 | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-002
Description: VRTB-D-06_07152024
Matrix: Aqueous
Date Sampled: 07/15/2024 1440
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 82 | 40-200 |
| 13C2-6:2FTS | | 86 | 40-200 |
| 13C2-8:2FTS | | 67 | 40-300 |
| 13C2-PFDoA | | 38 | 10-130 |
| 13C2-PFTeDA | | 30 | 10-130 |
| 13C3-HFPO-DA | | 82 | 40-130 |
| 13C3-PFBS | | 90 | 40-135 |
| 13C3-PFHxS | | 91 | 40-130 |
| 13C4-PFBA | | 84 | 5.0-130 |
| 13C4-PFHpA | | 80 | 40-130 |
| 13C5-PFHxA | | 84 | 40-130 |
| 13C5-PFPeA | | 86 | 40-130 |
| 13C6-PFDA | | 57 | 40-130 |
| 13C7-PFUnA | | 47 | 30-130 |
| 13C8-PFOA | | 81 | 40-130 |
| 13C8-PFOS | | 71 | 40-130 |
| 13C8-PFOSA | | 42 | 40-130 |
| 13C9-PFNA | | 76 | 40-130 |
| D3-NMeFOSA | | 27 | 10-130 |
| D3-NMeFOSAA | | 42 | 40-170 |
| D5-NEtFOSA | | 24 | 10-130 |
| D5-NEtFOSAA | | 33 | 25-135 |
| D7-NMeFOSE | | 30 | 10-130 |
| D9-NEtFOSE | | 19 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-003
Description: VRTB-D-R7_07152024 | Matrix: Aqueous
Date Sampled: 07/15/2024 1535 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/20/2024 0036 | BWS | 08/09/2024 1707 | 15907 |
| 2 | 1633 | 1633 | 1 | 08/24/2024 0546 | BWS | 08/22/2024 1636 | 16603 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UQ | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.2 | M-03 | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 12 | M-03 | 3.6 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.7 | | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 18 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 61 | | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 18 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.2 | M-03 | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 100 | M-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 13 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 1.9 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 20 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-003
Description: VRTB-D-R7_07152024
Matrix: Aqueous
Date Sampled: 07/15/2024 1535
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 72 | 40-200 | H | 88 | 40-200 |
| 13C2-6:2FTS | | 74 | 40-200 | H | 86 | 40-200 |
| 13C2-8:2FTS | | 60 | 40-300 | HM-03 | 74 | 40-300 |
| 13C2-PFDoA | | 47 | 10-130 | H | 48 | 10-130 |
| 13C2-PFTeDA | | 27 | 10-130 | H | 30 | 10-130 |
| 13C3-HFPO-DA | | 75 | 40-130 | H | 92 | 40-130 |
| 13C3-PFBS | | 78 | 40-135 | H | 91 | 40-135 |
| 13C3-PFHxS | | 77 | 40-130 | H | 89 | 40-130 |
| 13C4-PFBA | | 78 | 5.0-130 | H | 94 | 5.0-130 |
| 13C4-PFHpA | | 75 | 40-130 | H | 93 | 40-130 |
| 13C5-PFHxA | | 75 | 40-130 | H | 94 | 40-130 |
| 13C5-PFPeA | | 75 | 40-130 | H | 95 | 40-130 |
| 13C6-PFDA | | 68 | 40-130 | H | 79 | 40-130 |
| 13C7-PFUnA | | 55 | 30-130 | H | 62 | 30-130 |
| 13C8-PFOA | | 73 | 40-130 | H | 90 | 40-130 |
| 13C8-PFOS | | 69 | 40-130 | H | 81 | 40-130 |
| 13C8-PFOSA | | 43 | 40-130 | H | 74 | 40-130 |
| 13C9-PFNA | | 73 | 40-130 | H | 86 | 40-130 |
| D3-NMeFOSA | | 25 | 10-130 | H | 47 | 10-130 |
| D3-NMeFOSAA | | 48 | 40-170 | H | 57 | 40-170 |
| D5-NEtFOSA | | 24 | 10-130 | H | 41 | 10-130 |
| D5-NEtFOSAA | | 38 | 25-135 | H | 46 | 25-135 |
| D7-NMeFOSE | | 11 | 10-130 | H | 52 | 10-130 |
| D9-NEtFOSE | N | 6.0 | 10-130 | H | 44 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-003
Description: VRTB-D-R7_07152024 | Matrix: Aqueous
Date Sampled: 07/15/2024 1535 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/20/2024 0036 | BWS | 08/09/2024 1707 | 15907 |
| 2 | 1633 | 1633 | 1 | 08/24/2024 0546 | BWS | 08/22/2024 1636 | 16603 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | UH | 3.6 | 2.1 | 0.78 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | UH | 3.6 | 2.0 | 0.59 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | UH | 3.6 | 2.1 | 0.59 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | UH | 3.6 | 1.4 | 0.54 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | UH | 3.6 | 1.4 | 0.35 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | UH | 4.4 | 4.0 | 1.8 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | UH | 22 | 8.8 | 3.8 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | UH | 3.6 | 2.2 | 0.88 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.11 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.26 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UH | 8.9 | 1.8 | 0.54 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.19 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.26 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | UH | 8.9 | 1.8 | 0.56 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UH | 1.8 | 1.2 | 0.51 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | UH | 1.8 | 0.99 | 0.32 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | UH | 1.8 | 0.58 | 0.16 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UH | 1.8 | 1.2 | 0.35 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 4.8 | H | 0.89 | 0.31 | 0.083 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 11 | HM-03 | 3.6 | 1.4 | 0.45 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | UH | 0.89 | 0.35 | 0.15 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.12 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | UH | 0.89 | 0.35 | 0.14 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.095 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.7 | H | 0.89 | 0.34 | 0.17 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 17 | H | 0.89 | 0.71 | 0.19 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | UH | 22 | 8.8 | 3.7 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 53 | H | 0.89 | 0.65 | 0.16 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 16 | H | 0.89 | 0.36 | 0.13 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | UH | 0.89 | 0.34 | 0.13 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 1.1 | HLM-03 | 0.89 | 0.36 | 0.092 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.18 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 92 | HM-03 | 0.89 | 0.66 | 0.22 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 10 | HM-03 | 0.89 | 0.71 | 0.19 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 1.9 | HM-03 | 0.89 | 0.67 | 0.23 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 19 | HM-03 | 1.8 | 0.36 | 0.16 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | UH | 4.4 | 1.8 | 0.53 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.24 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.17 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.22 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-003
Description: VRTB-D-R7_07152024
Matrix: Aqueous
Date Sampled: 07/15/2024 1535
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 72 | 40-200 | H | 88 | 40-200 |
| 13C2-6:2FTS | | 74 | 40-200 | H | 86 | 40-200 |
| 13C2-8:2FTS | | 60 | 40-300 | HM-03 | 74 | 40-300 |
| 13C2-PFDoA | | 47 | 10-130 | H | 48 | 10-130 |
| 13C2-PFTeDA | | 27 | 10-130 | H | 30 | 10-130 |
| 13C3-HFPO-DA | | 75 | 40-130 | H | 92 | 40-130 |
| 13C3-PFBS | | 78 | 40-135 | H | 91 | 40-135 |
| 13C3-PFHxS | | 77 | 40-130 | H | 89 | 40-130 |
| 13C4-PFBA | | 78 | 5.0-130 | H | 94 | 5.0-130 |
| 13C4-PFHpA | | 75 | 40-130 | H | 93 | 40-130 |
| 13C5-PFHxA | | 75 | 40-130 | H | 94 | 40-130 |
| 13C5-PFPeA | | 75 | 40-130 | H | 95 | 40-130 |
| 13C6-PFDA | | 68 | 40-130 | H | 79 | 40-130 |
| 13C7-PFUnA | | 55 | 30-130 | H | 62 | 30-130 |
| 13C8-PFOA | | 73 | 40-130 | H | 90 | 40-130 |
| 13C8-PFOS | | 69 | 40-130 | H | 81 | 40-130 |
| 13C8-PFOSA | | 43 | 40-130 | H | 74 | 40-130 |
| 13C9-PFNA | | 73 | 40-130 | H | 86 | 40-130 |
| D3-NMeFOSA | | 25 | 10-130 | H | 47 | 10-130 |
| D3-NMeFOSAA | | 48 | 40-170 | H | 57 | 40-170 |
| D5-NEtFOSA | | 24 | 10-130 | H | 41 | 10-130 |
| D5-NEtFOSAA | | 38 | 25-135 | H | 46 | 25-135 |
| D7-NMeFOSE | | 11 | 10-130 | H | 52 | 10-130 |
| D9-NEtFOSE | N | 6.0 | 10-130 | H | 44 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-004
Description: VRTB-D-P8_07152024 | Matrix: Aqueous
Date Sampled: 07/15/2024 1625 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/20/2024 0045 | BWS | 08/09/2024 1707 | 15907 |
| 2 | 1633 | 1633 | 1 | 08/24/2024 0555 | BWS | 08/22/2024 1636 | 16603 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.1 | U | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.9 | M-03 | 0.89 | 0.31 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 12 | | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 4.1 | | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 22 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 120 | | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 20 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 6.7 | | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | UQ | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 310 | M-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 22 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 3.7 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 23 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-004
Description: VRTB-D-P8_07152024
Matrix: Aqueous
Date Sampled: 07/15/2024 1625
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 82 | 40-200 | H | 74 | 40-200 |
| 13C2-6:2FTS | | 84 | 40-200 | H | 70 | 40-200 |
| 13C2-8:2FTS | | 71 | 40-300 | H | 53 | 40-300 |
| 13C2-PFDoA | | 40 | 10-130 | H | 34 | 10-130 |
| 13C2-PFTeDA | | 27 | 10-130 | H | 13 | 10-130 |
| 13C3-HFPO-DA | | 84 | 40-130 | H | 75 | 40-130 |
| 13C3-PFBS | | 88 | 40-135 | H | 77 | 40-135 |
| 13C3-PFHxS | | 87 | 40-130 | H | 72 | 40-130 |
| 13C4-PFBA | | 83 | 5.0-130 | H | 78 | 5.0-130 |
| 13C4-PFHpA | | 81 | 40-130 | H | 78 | 40-130 |
| 13C5-PFHxA | | 85 | 40-130 | H | 77 | 40-130 |
| 13C5-PFPeA | | 85 | 40-130 | H | 78 | 40-130 |
| 13C6-PFDA | | 75 | 40-130 | HM-03 | 59 | 40-130 |
| 13C7-PFUnA | | 57 | 30-130 | H | 46 | 30-130 |
| 13C8-PFOA | | 82 | 40-130 | H | 75 | 40-130 |
| 13C8-PFOS | | 71 | 40-130 | H | 57 | 40-130 |
| 13C8-PFOSA | N | 38 | 40-130 | H | 54 | 40-130 |
| 13C9-PFNA | | 74 | 40-130 | H | 62 | 40-130 |
| D3-NMeFOSA | | 26 | 10-130 | H | 37 | 10-130 |
| D3-NMeFOSAA | | 44 | 40-170 | HM-03 | 42 | 40-170 |
| D5-NEtFOSA | | 23 | 10-130 | H | 28 | 10-130 |
| D5-NEtFOSAA | | 33 | 25-135 | HM-03 | 31 | 25-135 |
| D7-NMeFOSE | | 33 | 10-130 | H | 14 | 10-130 |
| D9-NEtFOSE | | 26 | 10-130 | HN | 6.0 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-004
Description: VRTB-D-P8_07152024 | Matrix: Aqueous
Date Sampled: 07/15/2024 1625 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/20/2024 0045 | BWS | 08/09/2024 1707 | 15907 |
| 2 | 1633 | 1633 | 1 | 08/24/2024 0555 | BWS | 08/22/2024 1636 | 16603 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | UH | 3.5 | 2.0 | 0.77 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | UH | 3.5 | 1.9 | 0.59 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | UH | 3.5 | 2.0 | 0.58 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.3 | UH | 3.5 | 1.3 | 0.53 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | UH | 3.5 | 1.3 | 0.35 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | UH | 4.4 | 4.0 | 1.8 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | UH | 22 | 8.8 | 3.8 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | UH | 3.5 | 2.1 | 0.87 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | UH | 0.88 | 0.35 | 0.11 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | UH | 0.88 | 0.70 | 0.26 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UHQ | 8.8 | 1.8 | 0.53 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | UH | 0.88 | 0.70 | 0.19 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | UH | 0.88 | 0.70 | 0.26 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | UH | 8.8 | 1.8 | 0.55 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UH | 1.8 | 1.2 | 0.51 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | UH | 1.8 | 0.99 | 0.32 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | UH | 1.8 | 0.58 | 0.16 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UH | 1.8 | 1.2 | 0.34 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.3 | HM-03 | 0.88 | 0.31 | 0.082 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 13 | HM-03 | 3.5 | 1.4 | 0.45 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | UH | 0.88 | 0.34 | 0.14 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.35 | UH | 0.88 | 0.35 | 0.12 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | UH | 0.88 | 0.34 | 0.14 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | UH | 0.88 | 0.35 | 0.094 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 5.4 | HM-03 | 0.88 | 0.33 | 0.17 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 24 | H | 0.88 | 0.70 | 0.19 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | UH | 22 | 8.8 | 3.7 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 130 | H | 0.88 | 0.64 | 0.16 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 21 | H | 0.88 | 0.35 | 0.12 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.33 | UH | 0.88 | 0.33 | 0.13 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 9.9 | HLM-03 | 0.88 | 0.35 | 0.090 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.35 | UH | 0.88 | 0.35 | 0.17 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 380 | HM-03 | 0.88 | 0.65 | 0.22 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 24 | HM-03 | 0.88 | 0.70 | 0.18 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 3.5 | HM-03 | 0.88 | 0.66 | 0.23 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 24 | HM-03 | 1.8 | 0.36 | 0.16 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | UH | 4.4 | 1.8 | 0.52 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | UH | 0.88 | 0.70 | 0.24 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | UH | 0.88 | 0.35 | 0.17 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | UH | 0.88 | 0.70 | 0.22 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-004
Description: VRTB-D-P8_07152024
Matrix: Aqueous
Date Sampled: 07/15/2024 1625
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 82 | 40-200 | H | 74 | 40-200 |
| 13C2-6:2FTS | | 84 | 40-200 | H | 70 | 40-200 |
| 13C2-8:2FTS | | 71 | 40-300 | H | 53 | 40-300 |
| 13C2-PFDoA | | 40 | 10-130 | H | 34 | 10-130 |
| 13C2-PFTeDA | | 27 | 10-130 | H | 13 | 10-130 |
| 13C3-HFPO-DA | | 84 | 40-130 | H | 75 | 40-130 |
| 13C3-PFBS | | 88 | 40-135 | H | 77 | 40-135 |
| 13C3-PFHxS | | 87 | 40-130 | H | 72 | 40-130 |
| 13C4-PFBA | | 83 | 5.0-130 | H | 78 | 5.0-130 |
| 13C4-PFHpA | | 81 | 40-130 | H | 78 | 40-130 |
| 13C5-PFHxA | | 85 | 40-130 | H | 77 | 40-130 |
| 13C5-PFPeA | | 85 | 40-130 | H | 78 | 40-130 |
| 13C6-PFDA | | 75 | 40-130 | HM-03 | 59 | 40-130 |
| 13C7-PFUnA | | 57 | 30-130 | H | 46 | 30-130 |
| 13C8-PFOA | | 82 | 40-130 | H | 75 | 40-130 |
| 13C8-PFOS | | 71 | 40-130 | H | 57 | 40-130 |
| 13C8-PFOSA | N | 38 | 40-130 | H | 54 | 40-130 |
| 13C9-PFNA | | 74 | 40-130 | H | 62 | 40-130 |
| D3-NMeFOSA | | 26 | 10-130 | H | 37 | 10-130 |
| D3-NMeFOSAA | | 44 | 40-170 | HM-03 | 42 | 40-170 |
| D5-NEtFOSA | | 23 | 10-130 | H | 28 | 10-130 |
| D5-NEtFOSAA | | 33 | 25-135 | HM-03 | 31 | 25-135 |
| D7-NMeFOSE | | 33 | 10-130 | H | 14 | 10-130 |
| D9-NEtFOSE | | 26 | 10-130 | HN | 6.0 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-005
Description: VRTB-S-B1_07152024 | Matrix: Aqueous
Date Sampled: 07/15/2024 1720 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/20/2024 0054 | BWS | 08/09/2024 1707 | 15907 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.77 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 3.1 | M-03 | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 4.1 | M-03 | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.2 | M-03 | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 2.9 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 27 | M-03 | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 3.8 | M-03 | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.31 | JM-03 | 0.89 | 0.36 | 0.091 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 150 | M-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 2.9 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 1.6 | M-03 | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 3.3 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-005
Description: VRTB-S-B1_07152024
Matrix: Aqueous
Date Sampled: 07/15/2024 1720
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 87 | 40-200 |
| 13C2-6:2FTS | | 87 | 40-200 |
| 13C2-8:2FTS | M-03 | 81 | 40-300 |
| 13C2-PFDoA | | 50 | 10-130 |
| 13C2-PFTeDA | | 39 | 10-130 |
| 13C3-HFPO-DA | | 95 | 40-130 |
| 13C3-PFBS | | 94 | 40-135 |
| 13C3-PFHxS | | 95 | 40-130 |
| 13C4-PFBA | | 93 | 5.0-130 |
| 13C4-PFHpA | | 92 | 40-130 |
| 13C5-PFHxA | | 97 | 40-130 |
| 13C5-PFPeA | | 96 | 40-130 |
| 13C6-PFDA | | 80 | 40-130 |
| 13C7-PFUnA | | 62 | 30-130 |
| 13C8-PFOA | | 93 | 40-130 |
| 13C8-PFOS | | 81 | 40-130 |
| 13C8-PFOSA | | 49 | 40-130 |
| 13C9-PFNA | | 82 | 40-130 |
| D3-NMeFOSA | | 34 | 10-130 |
| D3-NMeFOSAA | | 60 | 40-170 |
| D5-NEtFOSA | | 30 | 10-130 |
| D5-NEtFOSAA | | 42 | 25-135 |
| D7-NMeFOSE | | 42 | 10-130 |
| D9-NEtFOSE | | 34 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-006
Description: VRTB-S-S2_07152024 | Matrix: Aqueous
Date Sampled: 07/15/2024 1810 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/20/2024 0103 | BWS | 08/09/2024 1707 | 15907 |
| 2 | 1633 | 1633 | 5 | 08/21/2024 0817 | BWS | 08/09/2024 1707 | 15907 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.77 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.2 | M-03 | 0.88 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 19 | M-03 | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.094 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 9.7 | M-03 | 0.88 | 0.33 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 37 | | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 120 | | 0.88 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 35 | | 0.88 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.32 | JM-03 | 0.88 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 20 | | 0.88 | 0.35 | 0.091 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.2 | M-03 | 0.88 | 0.35 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 750 | M-03 | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 36 | M-03 | 0.88 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 6.9 | | 0.88 | 0.66 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 31 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-006
Description: VRTB-S-S2_07152024
Matrix: Aqueous
Date Sampled: 07/15/2024 1810
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 88 | 40-200 | | 83 | 40-200 |
| 13C2-6:2FTS | | 91 | 40-200 | M-03 | 88 | 40-200 |
| 13C2-8:2FTS | | 75 | 40-300 | | 71 | 40-300 |
| 13C2-PFDoA | | 45 | 10-130 | M-03 | 46 | 10-130 |
| 13C2-PFTeDA | | 32 | 10-130 | M-03 | 33 | 10-130 |
| 13C3-HFPO-DA | | 95 | 40-130 | | 87 | 40-130 |
| 13C3-PFBS | | 96 | 40-135 | | 88 | 40-135 |
| 13C3-PFHxS | | 96 | 40-130 | | 90 | 40-130 |
| 13C4-PFBA | | 89 | 5.0-130 | | 90 | 5.0-130 |
| 13C4-PFHpA | | 91 | 40-130 | | 86 | 40-130 |
| 13C5-PFHxA | | 93 | 40-130 | | 86 | 40-130 |
| 13C5-PFPeA | | 96 | 40-130 | | 88 | 40-130 |
| 13C6-PFDA | | 81 | 40-130 | M-03 | 78 | 40-130 |
| 13C7-PFUnA | | 61 | 30-130 | M-03 | 63 | 30-130 |
| 13C8-PFOA | | 85 | 40-130 | | 81 | 40-130 |
| 13C8-PFOS | | 80 | 40-130 | | 78 | 40-130 |
| 13C8-PFOSA | | 51 | 40-130 | | 47 | 40-130 |
| 13C9-PFNA | | 87 | 40-130 | | 70 | 40-130 |
| D3-NMeFOSA | | 34 | 10-130 | M-03 | 32 | 10-130 |
| D3-NMeFOSAA | | 56 | 40-170 | M-03 | 51 | 40-170 |
| D5-NEtFOSA | | 29 | 10-130 | | 28 | 10-130 |
| D5-NEtFOSAA | | 38 | 25-135 | M-03 | 35 | 25-135 |
| D7-NMeFOSE | | 34 | 10-130 | | 31 | 10-130 |
| D9-NEtFOSE | | 23 | 10-130 | | 21 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-007
Description: VRTB-S-Y3_07152024 | Matrix: Aqueous
Date Sampled: 07/15/2024 1910 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0107 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 5 | 08/24/2024 1850 | BWS | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.77 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.9 | JM-03 | 3.5 | 1.3 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 10 | | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 16 | | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 29 | | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 15 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 610 | M-03 | 4.4 | 3.2 | 0.82 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 37 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.39 | JM-03 | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 4.9 | M-03 | 0.89 | 0.36 | 0.091 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.5 | M-03 | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1100 | BM-03 | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 26 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 26 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 25 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-007
Description: VRTB-S-Y3_07152024
Matrix: Aqueous
Date Sampled: 07/15/2024 1910
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | M-03 | 89 | 40-200 | | 73 | 40-200 |
| 13C2-6:2FTS | | 82 | 40-200 | M-03 | 76 | 40-200 |
| 13C2-8:2FTS | | 75 | 40-300 | | 69 | 40-300 |
| 13C2-PFDoA | | 52 | 10-130 | | 51 | 10-130 |
| 13C2-PFTeDA | | 31 | 10-130 | | 32 | 10-130 |
| 13C3-HFPO-DA | | 73 | 40-130 | | 77 | 40-130 |
| 13C3-PFBS | | 85 | 40-135 | | 75 | 40-135 |
| 13C3-PFHxS | | 79 | 40-130 | | 71 | 40-130 |
| 13C4-PFBA | | 79 | 5.0-130 | | 80 | 5.0-130 |
| 13C4-PFHpA | | 76 | 40-130 | | 83 | 40-130 |
| 13C5-PFHxA | | 72 | 40-130 | | 82 | 40-130 |
| 13C5-PFPeA | | 75 | 40-130 | | 80 | 40-130 |
| 13C6-PFDA | | 76 | 40-130 | M-03 | 66 | 40-130 |
| 13C7-PFUnA | | 59 | 30-130 | | 71 | 30-130 |
| 13C8-PFOA | | 80 | 40-130 | | 73 | 40-130 |
| 13C8-PFOS | | 74 | 40-130 | | 69 | 40-130 |
| 13C8-PFOSA | | 63 | 40-130 | | 59 | 40-130 |
| 13C9-PFNA | | 81 | 40-130 | M-03 | 86 | 40-130 |
| D3-NMeFOSA | | 37 | 10-130 | | 33 | 10-130 |
| D3-NMeFOSAA | | 70 | 40-170 | | 58 | 40-170 |
| D5-NEtFOSA | | 31 | 10-130 | | 29 | 10-130 |
| D5-NEtFOSAA | | 52 | 25-135 | | 49 | 25-135 |
| D7-NMeFOSE | | 48 | 10-130 | | 42 | 10-130 |
| D9-NEtFOSE | | 39 | 10-130 | | 35 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-008
Description: VRTB-S-G4_07152024 | Matrix: Aqueous
Date Sampled: 07/15/2024 1955 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0116 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 5 | 08/24/2024 1859 | BWS | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.4 | | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 4.3 | M-03 | 3.6 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 17 | | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 6.1 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 300 | M-03 | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 15 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | UM-03 | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 2.2 | M-03 | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 950 | BM-03 | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 13 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 11 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 7.1 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-008
Description: VRTB-S-G4_07152024
Matrix: Aqueous
Date Sampled: 07/15/2024 1955
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 82 | 40-200 | | 72 | 40-200 |
| 13C2-6:2FTS | | 78 | 40-200 | | 65 | 40-200 |
| 13C2-8:2FTS | | 75 | 40-300 | | 70 | 40-300 |
| 13C2-PFDoA | | 40 | 10-130 | | 44 | 10-130 |
| 13C2-PFTeDA | | 30 | 10-130 | M-03 | 37 | 10-130 |
| 13C3-HFPO-DA | | 79 | 40-130 | | 73 | 40-130 |
| 13C3-PFBS | | 91 | 40-135 | | 70 | 40-135 |
| 13C3-PFHxS | | 84 | 40-130 | | 71 | 40-130 |
| 13C4-PFBA | | 77 | 5.0-130 | | 76 | 5.0-130 |
| 13C4-PFHpA | | 77 | 40-130 | | 72 | 40-130 |
| 13C5-PFHxA | | 76 | 40-130 | M-03 | 72 | 40-130 |
| 13C5-PFPeA | | 80 | 40-130 | | 74 | 40-130 |
| 13C6-PFDA | | 69 | 40-130 | | 79 | 40-130 |
| 13C7-PFUnA | | 51 | 30-130 | M-03 | 59 | 30-130 |
| 13C8-PFOA | | 74 | 40-130 | | 73 | 40-130 |
| 13C8-PFOS | | 73 | 40-130 | M-03 | 69 | 40-130 |
| 13C8-PFOSA | | 53 | 40-130 | | 47 | 40-130 |
| 13C9-PFNA | | 75 | 40-130 | M-03 | 72 | 40-130 |
| D3-NMeFOSA | | 27 | 10-130 | M-03 | 28 | 10-130 |
| D3-NMeFOSAA | | 54 | 40-170 | | 51 | 40-170 |
| D5-NEtFOSA | | 26 | 10-130 | | 24 | 10-130 |
| D5-NEtFOSAA | | 46 | 25-135 | M-03 | 42 | 25-135 |
| D7-NMeFOSE | | 35 | 10-130 | | 33 | 10-130 |
| D9-NEtFOSE | | 32 | 10-130 | | 30 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-009
Description: VRTB-D-B1_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1105 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0125 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 1908 | BWS | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 3.4 | JM-03 | 3.6 | 1.4 | 0.55 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 8.9 | M-03 | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.55 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.57 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 13 | M-03 | 0.90 | 0.32 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 17 | M-03 | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.096 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 34 | | 0.90 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 28 | | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 460 | | 0.90 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 37 | | 0.90 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.90 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 16 | M-03 | 0.90 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.27 | J | 0.90 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2200 | BM-03 | 9.0 | 6.7 | 2.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 56 | M-03 | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 25 | M-03 | 0.90 | 0.68 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 29 | M-03 | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-009
Description: VRTB-D-B1_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024 1105
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 84 | 40-200 | M-03 | 83 | 40-200 |
| 13C2-6:2FTS | | 78 | 40-200 | M-03 | 68 | 40-200 |
| 13C2-8:2FTS | | 72 | 40-300 | | 57 | 40-300 |
| 13C2-PFDoA | | 48 | 10-130 | | 41 | 10-130 |
| 13C2-PFTeDA | | 26 | 10-130 | M-03 | 24 | 10-130 |
| 13C3-HFPO-DA | | 73 | 40-130 | | 78 | 40-130 |
| 13C3-PFBS | | 86 | 40-135 | | 80 | 40-135 |
| 13C3-PFHxS | | 84 | 40-130 | | 76 | 40-130 |
| 13C4-PFBA | | 79 | 5.0-130 | | 79 | 5.0-130 |
| 13C4-PFHpA | | 81 | 40-130 | M-03 | 88 | 40-130 |
| 13C5-PFHxA | | 75 | 40-130 | | 76 | 40-130 |
| 13C5-PFPeA | | 82 | 40-130 | | 78 | 40-130 |
| 13C6-PFDA | | 76 | 40-130 | M-03 | 64 | 40-130 |
| 13C7-PFUnA | | 59 | 30-130 | | 60 | 30-130 |
| 13C8-PFOA | | 78 | 40-130 | | 73 | 40-130 |
| 13C8-PFOS | | 71 | 40-130 | M-03 | 69 | 40-130 |
| 13C8-PFOSA | | 68 | 40-130 | | 59 | 40-130 |
| 13C9-PFNA | | 72 | 40-130 | M-03 | 70 | 40-130 |
| D3-NMeFOSA | | 37 | 10-130 | | 35 | 10-130 |
| D3-NMeFOSAA | | 68 | 40-170 | | 52 | 40-170 |
| D5-NEtFOSA | | 33 | 10-130 | | 27 | 10-130 |
| D5-NEtFOSAA | M-03 | 50 | 25-135 | | 44 | 25-135 |
| D7-NMeFOSE | | 42 | 10-130 | | 37 | 10-130 |
| D9-NEtFOSE | | 31 | 10-130 | | 27 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-010
Description: VRTB-D-S2_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1150 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0134 | ARC2 | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 14 | | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 5.4 | M-03 | 3.6 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 6.8 | M-03 | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 6.3 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 160 | | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 11 | M-03 | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.58 | JM-03 | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 210 | BM-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 14 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 33 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 7.6 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-010
Description: VRTB-D-S2_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024 1150
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 73 | 40-200 |
| 13C2-6:2FTS | | 75 | 40-200 |
| 13C2-8:2FTS | | 72 | 40-300 |
| 13C2-PFDoA | | 48 | 10-130 |
| 13C2-PFTeDA | | 34 | 10-130 |
| 13C3-HFPO-DA | | 79 | 40-130 |
| 13C3-PFBS | | 81 | 40-135 |
| 13C3-PFHxS | | 73 | 40-130 |
| 13C4-PFBA | | 84 | 5.0-130 |
| 13C4-PFHpA | | 85 | 40-130 |
| 13C5-PFHxA | | 79 | 40-130 |
| 13C5-PFPeA | | 80 | 40-130 |
| 13C6-PFDA | | 86 | 40-130 |
| 13C7-PFUnA | | 69 | 30-130 |
| 13C8-PFOA | | 80 | 40-130 |
| 13C8-PFOS | | 76 | 40-130 |
| 13C8-PFOSA | | 56 | 40-130 |
| 13C9-PFNA | | 86 | 40-130 |
| D3-NMeFOSA | | 25 | 10-130 |
| D3-NMeFOSAA | | 50 | 40-170 |
| D5-NEtFOSA | | 21 | 10-130 |
| D5-NEtFOSAA | | 41 | 25-135 |
| D7-NMeFOSE | | 34 | 10-130 |
| D9-NEtFOSE | | 27 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-011
Description: VRTB-D-Y3_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1255 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0144 | ARC2 | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UM-03 | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 3.2 | M-03 | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 3.7 | M-03 | 3.6 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.8 | M-03 | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 3.3 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 61 | | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 5.5 | M-03 | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.31 | JM-03 | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 89 | BM-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 4.8 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 7.3 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 4.2 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-011
Description: VRTB-D-Y3_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024 1255
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 67 | 40-200 |
| 13C2-6:2FTS | | 66 | 40-200 |
| 13C2-8:2FTS | | 46 | 40-300 |
| 13C2-PFDoA | | 33 | 10-130 |
| 13C2-PFTeDA | | 23 | 10-130 |
| 13C3-HFPO-DA | | 67 | 40-130 |
| 13C3-PFBS | | 67 | 40-135 |
| 13C3-PFHxS | | 64 | 40-130 |
| 13C4-PFBA | | 70 | 5.0-130 |
| 13C4-PFHpA | | 67 | 40-130 |
| 13C5-PFHxA | | 67 | 40-130 |
| 13C5-PFPeA | | 69 | 40-130 |
| 13C6-PFDA | | 59 | 40-130 |
| 13C7-PFUnA | | 45 | 30-130 |
| 13C8-PFOA | | 67 | 40-130 |
| 13C8-PFOS | | 68 | 40-130 |
| 13C8-PFOSA | | 47 | 40-130 |
| 13C9-PFNA | | 70 | 40-130 |
| D3-NMeFOSA | | 26 | 10-130 |
| D3-NMeFOSAA | M-03 | 41 | 40-170 |
| D5-NEtFOSA | | 22 | 10-130 |
| D5-NEtFOSAA | | 35 | 25-135 |
| D7-NMeFOSE | | 31 | 10-130 |
| D9-NEtFOSE | | 26 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-012
Description: VRTB-D-G4_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1355 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0153 | ARC2 | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 0.89 | M-03 | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 7.1 | M-03 | 3.6 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 1.6 | M-03 | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 3.8 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 38 | M-03 | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 10 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 0.48 | JM-03 | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 120 | BM-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 3.7 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 1.5 | M-03 | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 12 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-012
Description: VRTB-D-G4_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024 1355
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 73 | 40-200 |
| 13C2-6:2FTS | | 72 | 40-200 |
| 13C2-8:2FTS | | 61 | 40-300 |
| 13C2-PFDoA | | 41 | 10-130 |
| 13C2-PFTeDA | | 35 | 10-130 |
| 13C3-HFPO-DA | | 86 | 40-130 |
| 13C3-PFBS | | 78 | 40-135 |
| 13C3-PFHxS | | 77 | 40-130 |
| 13C4-PFBA | | 84 | 5.0-130 |
| 13C4-PFHpA | | 89 | 40-130 |
| 13C5-PFHxA | | 85 | 40-130 |
| 13C5-PFPeA | | 88 | 40-130 |
| 13C6-PFDA | | 58 | 40-130 |
| 13C7-PFUnA | | 46 | 30-130 |
| 13C8-PFOA | | 72 | 40-130 |
| 13C8-PFOS | | 68 | 40-130 |
| 13C8-PFOSA | | 50 | 40-130 |
| 13C9-PFNA | | 81 | 40-130 |
| D3-NMeFOSA | | 30 | 10-130 |
| D3-NMeFOSAA | | 49 | 40-170 |
| D5-NEtFOSA | | 27 | 10-130 |
| D5-NEtFOSAA | | 40 | 25-135 |
| D7-NMeFOSE | | 39 | 10-130 |
| D9-NEtFOSE | | 35 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-013
Description: VRTB-S-M5_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1505 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0202 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 1917 | BWS | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.79 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 47 | | 3.6 | 1.4 | 0.55 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 44 | | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.90 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.55 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.57 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.9 | M-03 | 0.90 | 0.32 | 0.085 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 23 | | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.45 | JM-03 | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.096 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 54 | | 0.90 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 48 | | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.8 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 510 | M-03 | 0.90 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 68 | M-03 | 0.90 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.90 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 25 | M-03 | 0.90 | 0.36 | 0.093 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.65 | JM-03 | 0.90 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 4600 | BM-03 | 9.0 | 6.7 | 2.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 70 | M-03 | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 13 | | 0.90 | 0.68 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 52 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.54 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-013

Description: VRTB-S-M5_07162024 | Matrix: Aqueous

Date Sampled: 07/16/2024 1505 | Project Name: ESTCP Vertebrae

Date Received: 07/19/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 78 | 40-200 | | 75 | 40-200 |
| 13C2-6:2FTS | | 79 | 40-200 | M-03 | 62 | 40-200 |
| 13C2-8:2FTS | | 73 | 40-300 | M-03 | 56 | 40-300 |
| 13C2-PFDoA | | 41 | 10-130 | M-03 | 39 | 10-130 |
| 13C2-PFTeDA | | 29 | 10-130 | M-03 | 25 | 10-130 |
| 13C3-HFPO-DA | | 71 | 40-130 | | 65 | 40-130 |
| 13C3-PFBS | | 81 | 40-135 | | 69 | 40-135 |
| 13C3-PFHxS | | 76 | 40-130 | | 71 | 40-130 |
| 13C4-PFBA | | 76 | 5.0-130 | | 74 | 5.0-130 |
| 13C4-PFHpA | | 73 | 40-130 | | 67 | 40-130 |
| 13C5-PFHxA | | 68 | 40-130 | | 73 | 40-130 |
| 13C5-PFPeA | | 74 | 40-130 | | 72 | 40-130 |
| 13C6-PFDA | | 66 | 40-130 | | 56 | 40-130 |
| 13C7-PFUnA | | 53 | 30-130 | M-03 | 55 | 30-130 |
| 13C8-PFOA | | 91 | 40-130 | | 77 | 40-130 |
| 13C8-PFOS | M-03 | 70 | 40-130 | | 71 | 40-130 |
| 13C8-PFOSA | | 71 | 40-130 | M-03 | 58 | 40-130 |
| 13C9-PFNA | | 72 | 40-130 | | 74 | 40-130 |
| D3-NMeFOSA | | 35 | 10-130 | | 24 | 10-130 |
| D3-NMeFOSAA | | 69 | 40-170 | | 46 | 40-170 |
| D5-NEtFOSA | | 29 | 10-130 | M-03 | 24 | 10-130 |
| D5-NEtFOSAA | | 52 | 25-135 | M-03 | 40 | 25-135 |
| D7-NMeFOSE | | 47 | 10-130 | | 35 | 10-130 |
| D9-NEtFOSE | | 40 | 10-130 | | 29 | 10-130 |

| | | | | |
|---|---|---|---|---|
| LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure |
| U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure |
| H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure |

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-014
Description: VRTB-S-06_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1625 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0211 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 1926 | BWS | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.76 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.58 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.57 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.0 | J | 3.5 | 1.3 | 0.53 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.34 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 3.2 | JM-03 | 4.3 | 4.0 | 1.7 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.86 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.25 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.7 | U | 8.7 | 1.7 | 0.53 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.7 | U | 8.7 | 1.7 | 0.55 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.1 | U | 1.7 | 1.1 | 0.50 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.94 | U | 1.7 | 0.94 | 0.31 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.54 | U | 1.7 | 0.54 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.1 | U | 1.7 | 1.1 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.1 | | 0.87 | 0.30 | 0.081 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.9 | M-03 | 3.5 | 1.4 | 0.44 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.87 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.3 | | 0.87 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | U | 0.87 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.092 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 130 | | 0.87 | 0.33 | 0.16 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 15 | M-03 | 0.87 | 0.70 | 0.18 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.6 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 580 | M-03 | 8.7 | 6.4 | 1.6 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 23 | | 0.87 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.74 | JM-03 | 0.87 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 9.5 | M-03 | 0.87 | 0.35 | 0.089 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 7.8 | M-03 | 0.87 | 0.35 | 0.17 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2200 | BM-03 | 8.7 | 6.4 | 2.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 68 | M-03 | 0.87 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 22 | | 0.87 | 0.65 | 0.22 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 13 | M-03 | 1.7 | 0.34 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.7 | U | 4.3 | 1.7 | 0.52 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.21 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-014
Description: VRTB-S-06_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024 1625
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 73 | 40-200 | | 65 | 40-200 |
| 13C2-6:2FTS | | 70 | 40-200 | M-03 | 67 | 40-200 |
| 13C2-8:2FTS | | 48 | 40-300 | M-03 | 49 | 40-300 |
| 13C2-PFDoA | | 33 | 10-130 | | 34 | 10-130 |
| 13C2-PFTeDA | | 28 | 10-130 | | 33 | 10-130 |
| 13C3-HFPO-DA | | 72 | 40-130 | | 69 | 40-130 |
| 13C3-PFBS | | 77 | 40-135 | | 70 | 40-135 |
| 13C3-PFHxS | | 70 | 40-130 | | 69 | 40-130 |
| 13C4-PFBA | | 73 | 5.0-130 | | 73 | 5.0-130 |
| 13C4-PFHpA | | 73 | 40-130 | | 74 | 40-130 |
| 13C5-PFHxA | | 72 | 40-130 | | 74 | 40-130 |
| 13C5-PFPeA | | 73 | 40-130 | | 76 | 40-130 |
| 13C6-PFDA | M-03 | 48 | 40-130 | M-03 | 51 | 40-130 |
| 13C7-PFUnA | | 35 | 30-130 | M-03 | 46 | 30-130 |
| 13C8-PFOA | | 72 | 40-130 | M-03 | 70 | 40-130 |
| 13C8-PFOS | | 53 | 40-130 | M-03 | 53 | 40-130 |
| 13C8-PFOSA | | 44 | 40-130 | N | 37 | 40-130 |
| 13C9-PFNA | | 68 | 40-130 | M-03 | 65 | 40-130 |
| D3-NMeFOSA | | 22 | 10-130 | | 16 | 10-130 |
| D3-NMeFOSAA | | 41 | 40-170 | N | 35 | 40-170 |
| D5-NEtFOSA | M-03 | 20 | 10-130 | | 17 | 10-130 |
| D5-NEtFOSAA | | 33 | 25-135 | N | 24 | 25-135 |
| D7-NMeFOSE | | 31 | 10-130 | | 26 | 10-130 |
| D9-NEtFOSE | | 27 | 10-130 | | 24 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-015
Description: VRTB-S-R7_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1735 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0220 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 1936 | BWS | 08/09/2024 1707 | 15908 |
| 3 | 1633 | 1633 | 1 | 08/27/2024 0256 | ARC2 | 08/23/2024 1526 | 16856 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.76 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.58 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 66 | M-03 | 3.5 | 1.3 | 0.53 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.34 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 90 | | 4.3 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.86 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.25 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.7 | U | 8.7 | 1.7 | 0.53 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.7 | U | 8.7 | 1.7 | 0.55 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.1 | U | 1.7 | 1.1 | 0.50 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.94 | U | 1.7 | 0.94 | 0.31 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.54 | U | 1.7 | 0.54 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.1 | U | 1.7 | 1.1 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 29 | | 0.87 | 0.30 | 0.081 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 39 | | 3.5 | 1.4 | 0.44 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.87 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | JM-03 | 0.87 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | U | 0.87 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.092 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 300 | | 0.87 | 0.33 | 0.16 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 90 | | 0.87 | 0.70 | 0.18 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.6 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2100 | EM-03 | 0.87 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 210 | M-03 | 0.87 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.5 | M-03 | 0.87 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 100 | M-03 | 0.87 | 0.35 | 0.089 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 5.4 | M-03 | 0.87 | 0.35 | 0.17 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 30000 | BEM-03 | 0.87 | 0.64 | 0.21 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 220 | M-03 | 0.87 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 75 | | 0.87 | 0.65 | 0.22 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 88 | M-03 | 1.7 | 0.34 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.7 | U | 4.3 | 1.7 | 0.52 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.21 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-015
Description: VRTB-S-R7_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1735 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 40-200 | M-03 | 66 | 40-200 | H | 84 | 40-200 |
| 13C2-6:2FTS | | 73 | 40-200 | | 66 | 40-200 | H | 81 | 40-200 |
| 13C2-8:2FTS | | 67 | 40-300 | | 55 | 40-300 | HM-03 | 78 | 40-300 |
| 13C2-PFDoA | | 41 | 10-130 | | 41 | 10-130 | H | 70 | 10-130 |
| 13C2-PFTeDA | | 35 | 10-130 | M-03 | 30 | 10-130 | H | 67 | 10-130 |
| 13C3-HFPO-DA | | 67 | 40-130 | | 64 | 40-130 | H | 86 | 40-130 |
| 13C3-PFBS | | 89 | 40-135 | M-03 | 69 | 40-135 | H | 85 | 40-135 |
| 13C3-PFHxS | | 72 | 40-130 | | 63 | 40-130 | H | 83 | 40-130 |
| 13C4-PFBA | | 71 | 5.0-130 | | 73 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 72 | 40-130 | | 76 | 40-130 | H | 86 | 40-130 |
| 13C5-PFHxA | | 68 | 40-130 | | 68 | 40-130 | H | 86 | 40-130 |
| 13C5-PFPeA | | 70 | 40-130 | | 71 | 40-130 | H | 88 | 40-130 |
| 13C6-PFDA | | 60 | 40-130 | | 61 | 40-130 | H | 77 | 40-130 |
| 13C7-PFUnA | | 46 | 30-130 | | 49 | 30-130 | H | 75 | 30-130 |
| 13C8-PFOA | | 70 | 40-130 | | 66 | 40-130 | H | 90 | 40-130 |
| 13C8-PFOS | M-03 | 63 | 40-130 | M-03 | 60 | 40-130 | H | 80 | 40-130 |
| 13C8-PFOSA | | 101 | 40-130 | | 55 | 40-130 | H | 91 | 40-130 |
| 13C9-PFNA | | 69 | 40-130 | M-03 | 72 | 40-130 | H | 78 | 40-130 |
| D3-NMeFOSA | | 59 | 10-130 | | 36 | 10-130 | H | 67 | 10-130 |
| D3-NMeFOSAA | | 111 | 40-170 | M-03 | 56 | 40-170 | H | 83 | 40-170 |
| D5-NEtFOSA | | 57 | 10-130 | | 32 | 10-130 | H | 67 | 10-130 |
| D5-NEtFOSAA | | 72 | 25-135 | | 42 | 25-135 | H | 77 | 25-135 |
| D7-NMeFOSE | | 72 | 10-130 | | 39 | 10-130 | H | 82 | 10-130 |
| D9-NEtFOSE | | 64 | 10-130 | | 37 | 10-130 | H | 77 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-015
Description: VRTB-S-R7_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024 1735
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0220 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 1936 | BWS | 08/09/2024 1707 | 15908 |
| 3 | 1633 | 1633 | 1 | 08/27/2024 0256 | ARC2 | 08/23/2024 1526 | 16856 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 20 | U | 35 | 20 | 7.6 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 19 | U | 35 | 19 | 5.8 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 20 | U | 35 | 20 | 5.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 78 | M-03 | 35 | 13 | 5.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 13 | U | 35 | 13 | 3.4 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 84 | M-03 | 43 | 40 | 18 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 88 | U | 220 | 88 | 37 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 21 | U | 35 | 21 | 8.6 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.5 | U | 8.7 | 3.5 | 1.1 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.0 | U | 8.7 | 7.0 | 2.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 17 | U | 87 | 17 | 5.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.0 | U | 8.7 | 7.0 | 1.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.0 | U | 8.7 | 7.0 | 2.6 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 17 | U | 87 | 17 | 5.5 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 11 | U | 17 | 11 | 5.0 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 9.4 | U | 17 | 9.4 | 3.1 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 5.4 | U | 17 | 5.4 | 1.6 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 11 | U | 17 | 11 | 3.4 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 30 | M-03 | 8.7 | 3.0 | 0.81 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 39 | | 35 | 14 | 4.4 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.4 | U | 8.7 | 3.4 | 1.4 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.5 | U | 8.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.4 | U | 8.7 | 3.4 | 1.3 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.5 | U | 8.7 | 3.5 | 0.92 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 200 | | 8.7 | 3.3 | 1.6 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 89 | | 8.7 | 7.0 | 1.8 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 88 | U | 220 | 88 | 36 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2200 | M-03 | 8.7 | 6.4 | 1.6 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 220 | | 8.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.3 | U | 8.7 | 3.3 | 1.3 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 91 | M-03 | 8.7 | 3.5 | 0.89 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 5.5 | JM-09 | 8.7 | 3.5 | 1.7 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 29000 | BEM-03 | 8.7 | 6.4 | 2.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 250 | M-03 | 8.7 | 7.0 | 1.8 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 69 | | 8.7 | 6.5 | 2.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 87 | | 17 | 3.4 | 1.6 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 17 | U | 43 | 17 | 5.2 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.0 | U | 8.7 | 7.0 | 2.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.5 | U | 8.7 | 3.5 | 1.7 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.0 | U | 8.7 | 7.0 | 2.1 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-015

Description: VRTB-S-R7_07162024 | Matrix: Aqueous

Date Sampled: 07/16/2024 1735 | Project Name: ESTCP Vertebrae

Date Received: 07/19/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 40-200 | M-03 | 66 | 40-200 | H | 84 | 40-200 |
| 13C2-6:2FTS | | 73 | 40-200 | | 66 | 40-200 | H | 81 | 40-200 |
| 13C2-8:2FTS | | 67 | 40-300 | | 55 | 40-300 | HM-03 | 78 | 40-300 |
| 13C2-PFDoA | | 41 | 10-130 | | 41 | 10-130 | H | 70 | 10-130 |
| 13C2-PFTeDA | | 35 | 10-130 | M-03 | 30 | 10-130 | H | 67 | 10-130 |
| 13C3-HFPO-DA | | 67 | 40-130 | | 64 | 40-130 | H | 86 | 40-130 |
| 13C3-PFBS | | 89 | 40-135 | M-03 | 69 | 40-135 | H | 85 | 40-135 |
| 13C3-PFHxS | | 72 | 40-130 | | 63 | 40-130 | H | 83 | 40-130 |
| 13C4-PFBA | | 71 | 5.0-130 | | 73 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 72 | 40-130 | | 76 | 40-130 | H | 86 | 40-130 |
| 13C5-PFHxA | | 68 | 40-130 | | 68 | 40-130 | H | 86 | 40-130 |
| 13C5-PFPeA | | 70 | 40-130 | | 71 | 40-130 | H | 88 | 40-130 |
| 13C6-PFDA | | 60 | 40-130 | | 61 | 40-130 | H | 77 | 40-130 |
| 13C7-PFUnA | | 46 | 30-130 | | 49 | 30-130 | H | 75 | 30-130 |
| 13C8-PFOA | | 70 | 40-130 | | 66 | 40-130 | H | 90 | 40-130 |
| 13C8-PFOS | M-03 | 63 | 40-130 | M-03 | 60 | 40-130 | H | 80 | 40-130 |
| 13C8-PFOSA | | 101 | 40-130 | | 55 | 40-130 | H | 91 | 40-130 |
| 13C9-PFNA | | 69 | 40-130 | M-03 | 72 | 40-130 | H | 78 | 40-130 |
| D3-NMeFOSA | | 59 | 10-130 | | 36 | 10-130 | H | 67 | 10-130 |
| D3-NMeFOSAA | | 111 | 40-170 | M-03 | 56 | 40-170 | H | 83 | 40-170 |
| D5-NEtFOSA | | 57 | 10-130 | | 32 | 10-130 | H | 67 | 10-130 |
| D5-NEtFOSAA | | 72 | 25-135 | | 42 | 25-135 | H | 77 | 25-135 |
| D7-NMeFOSE | | 72 | 10-130 | | 39 | 10-130 | H | 82 | 10-130 |
| D9-NEtFOSE | | 64 | 10-130 | | 37 | 10-130 | H | 77 | 10-130 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-015
Description: VRTB-S-R7_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1735 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0220 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 1936 | BWS | 08/09/2024 1707 | 15908 |
| 3 | 1633 | 1633 | 1 | 08/27/2024 0256 | ARC2 | 08/23/2024 1526 | 16856 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | UH | 400 | 230 | 87 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | UH | 400 | 220 | 67 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | UH | 400 | 230 | 66 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 150 | UH | 400 | 150 | 61 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | UH | 400 | 150 | 40 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 460 | UH | 500 | 460 | 200 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | UH | 2500 | 1000 | 430 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | UH | 400 | 240 | 99 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | UH | 100 | 40 | 13 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | UH | 1000 | 200 | 61 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | UH | 100 | 80 | 22 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | UH | 1000 | 200 | 63 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | UH | 200 | 130 | 58 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | UH | 200 | 110 | 36 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | UH | 200 | 64 | 18 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | UH | 200 | 130 | 39 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 31 | HJM-03 | 100 | 35 | 9.4 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 160 | UHM-03 | 400 | 160 | 51 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | UH | 100 | 39 | 16 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | UH | 100 | 40 | 14 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | UH | 100 | 39 | 15 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | UH | 100 | 40 | 11 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 140 | H | 100 | 38 | 19 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 98 | HJM-03 | 100 | 80 | 21 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | UH | 2500 | 1000 | 420 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1800 | HM-03 | 100 | 73 | 18 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 200 | HM-03 | 100 | 40 | 14 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | UH | 100 | 38 | 15 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 83 | HJM-03 | 100 | 40 | 10 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 40 | UH | 100 | 40 | 20 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 23000 | HM-03 | 100 | 74 | 25 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 200 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 62 | HJM-03 | 100 | 75 | 26 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 40 | UH | 200 | 40 | 18 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | UH | 500 | 200 | 60 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | UH | 100 | 80 | 27 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | UH | 100 | 40 | 19 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | UH | 100 | 80 | 25 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-015
Description: VRTB-S-R7_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024 1735
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 85 | 40-200 | M-03 | 66 | 40-200 | H | 84 | 40-200 |
| 13C2-6:2FTS | | 73 | 40-200 | | 66 | 40-200 | H | 81 | 40-200 |
| 13C2-8:2FTS | | 67 | 40-300 | | 55 | 40-300 | HM-03 | 78 | 40-300 |
| 13C2-PFDoA | | 41 | 10-130 | | 41 | 10-130 | H | 70 | 10-130 |
| 13C2-PFTeDA | | 35 | 10-130 | M-03 | 30 | 10-130 | H | 67 | 10-130 |
| 13C3-HFPO-DA | | 67 | 40-130 | | 64 | 40-130 | H | 86 | 40-130 |
| 13C3-PFBS | | 89 | 40-135 | M-03 | 69 | 40-135 | H | 85 | 40-135 |
| 13C3-PFHxS | | 72 | 40-130 | | 63 | 40-130 | H | 83 | 40-130 |
| 13C4-PFBA | | 71 | 5.0-130 | | 73 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 72 | 40-130 | | 76 | 40-130 | H | 86 | 40-130 |
| 13C5-PFHxA | | 68 | 40-130 | | 68 | 40-130 | H | 86 | 40-130 |
| 13C5-PFPeA | | 70 | 40-130 | | 71 | 40-130 | H | 88 | 40-130 |
| 13C6-PFDA | | 60 | 40-130 | | 61 | 40-130 | H | 77 | 40-130 |
| 13C7-PFUnA | | 46 | 30-130 | | 49 | 30-130 | H | 75 | 30-130 |
| 13C8-PFOA | | 70 | 40-130 | | 66 | 40-130 | H | 90 | 40-130 |
| 13C8-PFOS | M-03 | 63 | 40-130 | M-03 | 60 | 40-130 | H | 80 | 40-130 |
| 13C8-PFOSA | | 101 | 40-130 | | 55 | 40-130 | H | 91 | 40-130 |
| 13C9-PFNA | | 69 | 40-130 | M-03 | 72 | 40-130 | H | 78 | 40-130 |
| D3-NMeFOSA | | 59 | 10-130 | | 36 | 10-130 | H | 67 | 10-130 |
| D3-NMeFOSAA | | 111 | 40-170 | M-03 | 56 | 40-170 | H | 83 | 40-170 |
| D5-NEtFOSA | | 57 | 10-130 | | 32 | 10-130 | H | 67 | 10-130 |
| D5-NEtFOSAA | | 72 | 25-135 | | 42 | 25-135 | H | 77 | 25-135 |
| D7-NMeFOSE | | 72 | 10-130 | | 39 | 10-130 | H | 82 | 10-130 |
| D9-NEtFOSE | | 64 | 10-130 | | 37 | 10-130 | H | 77 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-016
Description: VRTB-S-P8_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024 1840
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0230 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 1954 | BWS | 08/09/2024 1707 | 15908 |
| 3 | 1633 | 1633 | 1 | 08/27/2024 0306 | ARC2 | 08/23/2024 1526 | 16856 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 16 | | 3.6 | 1.4 | 0.55 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 35 | | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.55 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.57 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 31 | M-03 | 0.90 | 0.32 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 22 | M-03 | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.096 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 180 | | 0.90 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 37 | | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 940 | E | 0.90 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 110 | | 0.90 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.57 | JM-03 | 0.90 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 41 | M-03 | 0.90 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.5 | M-03 | 0.90 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 15000 | BEM-03 | 0.90 | 0.67 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 100 | | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 48 | | 0.90 | 0.68 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 41 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-016
Description: VRTB-S-P8_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024 1840
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 82 | 40-200 | | 83 | 40-200 | H | 86 | 40-200 |
| 13C2-6:2FTS | | 85 | 40-200 | | 79 | 40-200 | H | 76 | 40-200 |
| 13C2-8:2FTS | | 64 | 40-300 | | 66 | 40-300 | H | 83 | 40-300 |
| 13C2-PFDoA | | 35 | 10-130 | | 32 | 10-130 | H | 72 | 10-130 |
| 13C2-PFTeDA | | 28 | 10-130 | | 27 | 10-130 | H | 70 | 10-130 |
| 13C3-HFPO-DA | | 81 | 40-130 | | 70 | 40-130 | H | 84 | 40-130 |
| 13C3-PFBS | | 87 | 40-135 | | 80 | 40-135 | H | 90 | 40-135 |
| 13C3-PFHxS | | 78 | 40-130 | | 79 | 40-130 | H | 88 | 40-130 |
| 13C4-PFBA | | 80 | 5.0-130 | | 79 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 80 | 40-130 | | 79 | 40-130 | H | 80 | 40-130 |
| 13C5-PFHxA | | 78 | 40-130 | | 77 | 40-130 | H | 83 | 40-130 |
| 13C5-PFPeA | | 80 | 40-130 | | 75 | 40-130 | H | 86 | 40-130 |
| 13C6-PFDA | | 61 | 40-130 | M-03 | 56 | 40-130 | H | 80 | 40-130 |
| 13C7-PFUnA | | 44 | 30-130 | M-03 | 45 | 30-130 | H | 78 | 30-130 |
| 13C8-PFOA | | 77 | 40-130 | M-03 | 77 | 40-130 | H | 88 | 40-130 |
| 13C8-PFOS | | 68 | 40-130 | | 67 | 40-130 | H | 81 | 40-130 |
| 13C8-PFOSA | | 78 | 40-130 | | 54 | 40-130 | H | 87 | 40-130 |
| 13C9-PFNA | | 82 | 40-130 | M-03 | 68 | 40-130 | H | 86 | 40-130 |
| D3-NMeFOSA | | 43 | 10-130 | | 28 | 10-130 | H | 66 | 10-130 |
| D3-NMeFOSAA | | 67 | 40-170 | | 42 | 40-170 | H | 79 | 40-170 |
| D5-NEtFOSA | | 37 | 10-130 | M-03 | 26 | 10-130 | H | 64 | 10-130 |
| D5-NEtFOSAA | | 41 | 25-135 | M-03 | 36 | 25-135 | HM-03 | 79 | 25-135 |
| D7-NMeFOSE | | 53 | 10-130 | | 35 | 10-130 | H | 73 | 10-130 |
| D9-NEtFOSE | | 43 | 10-130 | | 28 | 10-130 | H | 70 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-016
Description: VRTB-S-P8_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1840 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0230 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 1954 | BWS | 08/09/2024 1707 | 15908 |
| 3 | 1633 | 1633 | 1 | 08/27/2024 0306 | ARC2 | 08/23/2024 1526 | 16856 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 21 | U | 36 | 21 | 7.8 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 20 | U | 36 | 20 | 6.0 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 21 | U | 36 | 21 | 6.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 12 | JM-03 | 36 | 14 | 5.5 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 14 | U | 36 | 14 | 3.6 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 29 | J | 45 | 41 | 18 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 88 | U | 220 | 88 | 39 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 22 | U | 36 | 22 | 8.9 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.6 | U | 9.0 | 3.6 | 1.2 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.2 | U | 9.0 | 7.2 | 2.6 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 18 | U | 90 | 18 | 5.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.2 | U | 9.0 | 7.2 | 1.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.2 | U | 9.0 | 7.2 | 2.6 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 18 | U | 90 | 18 | 5.7 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 12 | U | 18 | 12 | 5.2 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 9.9 | U | 18 | 9.9 | 3.2 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 5.8 | U | 18 | 5.8 | 1.7 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 12 | U | 18 | 12 | 3.5 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 31 | | 9.0 | 3.2 | 0.84 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 24 | JM-09 | 36 | 14 | 4.6 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.5 | U | 9.0 | 3.5 | 1.5 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.6 | U | 9.0 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.5 | U | 9.0 | 3.5 | 1.4 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.6 | U | 9.0 | 3.6 | 0.96 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 120 | M-09 | 9.0 | 3.4 | 1.7 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 40 | | 9.0 | 7.2 | 1.9 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 88 | U | 220 | 88 | 37 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1000 | M-03 | 9.0 | 6.6 | 1.7 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 110 | M-03 | 9.0 | 3.6 | 1.3 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.4 | UM-03 | 9.0 | 3.4 | 1.3 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 47 | M-03 | 9.0 | 3.6 | 0.92 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.6 | U | 9.0 | 3.6 | 1.8 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 14000 | BEM-03 | 9.0 | 6.7 | 2.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 99 | M-03 | 9.0 | 7.2 | 1.9 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 43 | | 9.0 | 6.8 | 2.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 42 | M-09 | 18 | 3.6 | 1.7 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 18 | U | 45 | 18 | 5.3 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.2 | U | 9.0 | 7.2 | 2.4 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.6 | U | 9.0 | 3.6 | 1.7 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.2 | U | 9.0 | 7.2 | 2.2 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-016
Description: VRTB-S-P8_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1840 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 82 | 40-200 | | 83 | 40-200 | H | 86 | 40-200 |
| 13C2-6:2FTS | | 85 | 40-200 | | 79 | 40-200 | H | 76 | 40-200 |
| 13C2-8:2FTS | | 64 | 40-300 | | 66 | 40-300 | H | 83 | 40-300 |
| 13C2-PFDoA | | 35 | 10-130 | | 32 | 10-130 | H | 72 | 10-130 |
| 13C2-PFTeDA | | 28 | 10-130 | | 27 | 10-130 | H | 70 | 10-130 |
| 13C3-HFPO-DA | | 81 | 40-130 | | 70 | 40-130 | H | 84 | 40-130 |
| 13C3-PFBS | | 87 | 40-135 | | 80 | 40-135 | H | 90 | 40-135 |
| 13C3-PFHxS | | 78 | 40-130 | | 79 | 40-130 | H | 88 | 40-130 |
| 13C4-PFBA | | 80 | 5.0-130 | | 79 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 80 | 40-130 | | 79 | 40-130 | H | 80 | 40-130 |
| 13C5-PFHxA | | 78 | 40-130 | | 77 | 40-130 | H | 83 | 40-130 |
| 13C5-PFPeA | | 80 | 40-130 | | 75 | 40-130 | H | 86 | 40-130 |
| 13C6-PFDA | | 61 | 40-130 | M-03 | 56 | 40-130 | H | 80 | 40-130 |
| 13C7-PFUnA | | 44 | 30-130 | M-03 | 45 | 30-130 | H | 78 | 30-130 |
| 13C8-PFOA | | 77 | 40-130 | M-03 | 77 | 40-130 | H | 88 | 40-130 |
| 13C8-PFOS | | 68 | 40-130 | | 67 | 40-130 | H | 81 | 40-130 |
| 13C8-PFOSA | | 78 | 40-130 | | 54 | 40-130 | H | 87 | 40-130 |
| 13C9-PFNA | | 82 | 40-130 | M-03 | 68 | 40-130 | H | 86 | 40-130 |
| D3-NMeFOSA | | 43 | 10-130 | | 28 | 10-130 | H | 66 | 10-130 |
| D3-NMeFOSAA | | 67 | 40-170 | | 42 | 40-170 | H | 79 | 40-170 |
| D5-NEtFOSA | | 37 | 10-130 | M-03 | 26 | 10-130 | H | 64 | 10-130 |
| D5-NEtFOSAA | | 41 | 25-135 | M-03 | 36 | 25-135 | HM-03 | 79 | 25-135 |
| D7-NMeFOSE | | 53 | 10-130 | | 35 | 10-130 | H | 73 | 10-130 |
| D9-NEtFOSE | | 43 | 10-130 | | 28 | 10-130 | H | 70 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-016
Description: VRTB-S-P8_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024 1840
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0230 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 1954 | BWS | 08/09/2024 1707 | 15908 |
| 3 | 1633 | 1633 | 1 | 08/27/2024 0306 | ARC2 | 08/23/2024 1526 | 16856 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 75 | UH | 200 | 75 | 30 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 230 | UH | 250 | 230 | 100 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 32 | HJ | 50 | 18 | 4.7 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 80 | UHM-03 | 200 | 80 | 26 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 88 | HM-03 | 50 | 19 | 9.5 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 40 | HJM-03 | 50 | 40 | 11 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 940 | HM-03 | 50 | 37 | 9.2 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 110 | HM-03 | 50 | 20 | 7.1 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 37 | HJM-03 | 50 | 20 | 5.2 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 11000 | HM-03 | 50 | 37 | 12 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 110 | HM-03 | 50 | 40 | 10 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 44 | HJM-03 | 50 | 38 | 13 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 20 | UH | 100 | 20 | 9.2 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-016
Description: VRTB-S-P8_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 1840 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 82 | 40-200 | | 83 | 40-200 | H | 86 | 40-200 |
| 13C2-6:2FTS | | 85 | 40-200 | | 79 | 40-200 | H | 76 | 40-200 |
| 13C2-8:2FTS | | 64 | 40-300 | | 66 | 40-300 | H | 83 | 40-300 |
| 13C2-PFDoA | | 35 | 10-130 | | 32 | 10-130 | H | 72 | 10-130 |
| 13C2-PFTeDA | | 28 | 10-130 | | 27 | 10-130 | H | 70 | 10-130 |
| 13C3-HFPO-DA | | 81 | 40-130 | | 70 | 40-130 | H | 84 | 40-130 |
| 13C3-PFBS | | 87 | 40-135 | | 80 | 40-135 | H | 90 | 40-135 |
| 13C3-PFHxS | | 78 | 40-130 | | 79 | 40-130 | H | 88 | 40-130 |
| 13C4-PFBA | | 80 | 5.0-130 | | 79 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 80 | 40-130 | | 79 | 40-130 | H | 80 | 40-130 |
| 13C5-PFHxA | | 78 | 40-130 | | 77 | 40-130 | H | 83 | 40-130 |
| 13C5-PFPeA | | 80 | 40-130 | | 75 | 40-130 | H | 86 | 40-130 |
| 13C6-PFDA | | 61 | 40-130 | M-03 | 56 | 40-130 | H | 80 | 40-130 |
| 13C7-PFUnA | | 44 | 30-130 | M-03 | 45 | 30-130 | H | 78 | 30-130 |
| 13C8-PFOA | | 77 | 40-130 | M-03 | 77 | 40-130 | H | 88 | 40-130 |
| 13C8-PFOS | | 68 | 40-130 | | 67 | 40-130 | H | 81 | 40-130 |
| 13C8-PFOSA | | 78 | 40-130 | | 54 | 40-130 | H | 87 | 40-130 |
| 13C9-PFNA | | 82 | 40-130 | M-03 | 68 | 40-130 | H | 86 | 40-130 |
| D3-NMeFOSA | | 43 | 10-130 | | 28 | 10-130 | H | 66 | 10-130 |
| D3-NMeFOSAA | | 67 | 40-170 | | 42 | 40-170 | H | 79 | 40-170 |
| D5-NEtFOSA | | 37 | 10-130 | M-03 | 26 | 10-130 | H | 64 | 10-130 |
| D5-NEtFOSAA | | 41 | 25-135 | M-03 | 36 | 25-135 | HM-03 | 79 | 25-135 |
| D7-NMeFOSE | | 53 | 10-130 | | 35 | 10-130 | H | 73 | 10-130 |
| D9-NEtFOSE | | 43 | 10-130 | | 28 | 10-130 | H | 70 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-017
Description: VRTB-L-B1_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1000 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0257 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 2003 | BWS | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.77 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 47 | | 3.5 | 1.3 | 0.53 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 14 | M-03 | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.87 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.53 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.55 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.1 | | 0.88 | 0.31 | 0.082 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 13 | M-03 | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.39 | JM-03 | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.094 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 28 | | 0.88 | 0.33 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 25 | | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 210 | | 0.88 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 28 | | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.13 | JM-03 | 0.88 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 15 | M-03 | 0.88 | 0.35 | 0.090 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.8 | M-03 | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 2700 | BM-03 | 8.8 | 6.5 | 2.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 40 | M-03 | 0.88 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 8.3 | | 0.88 | 0.66 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 23 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.52 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-017
Description: VRTB-L-B1_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1000
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 89 | 40-200 | | 76 | 40-200 |
| 13C2-6:2FTS | | 90 | 40-200 | | 82 | 40-200 |
| 13C2-8:2FTS | M-03 | 71 | 40-300 | M-03 | 61 | 40-300 |
| 13C2-PFDoA | | 38 | 10-130 | M-03 | 35 | 10-130 |
| 13C2-PFTeDA | | 31 | 10-130 | | 29 | 10-130 |
| 13C3-HFPO-DA | | 81 | 40-130 | | 82 | 40-130 |
| 13C3-PFBS | | 85 | 40-135 | | 86 | 40-135 |
| 13C3-PFHxS | | 82 | 40-130 | M-03 | 93 | 40-130 |
| 13C4-PFBA | | 86 | 5.0-130 | | 84 | 5.0-130 |
| 13C4-PFHpA | | 84 | 40-130 | | 78 | 40-130 |
| 13C5-PFHxA | | 79 | 40-130 | | 74 | 40-130 |
| 13C5-PFPeA | | 85 | 40-130 | | 78 | 40-130 |
| 13C6-PFDA | | 69 | 40-130 | | 62 | 40-130 |
| 13C7-PFUnA | | 48 | 30-130 | | 50 | 30-130 |
| 13C8-PFOA | | 90 | 40-130 | | 98 | 40-130 |
| 13C8-PFOS | | 73 | 40-130 | | 70 | 40-130 |
| 13C8-PFOSA | | 69 | 40-130 | | 53 | 40-130 |
| 13C9-PFNA | M-03 | 83 | 40-130 | M-03 | 84 | 40-130 |
| D3-NMeFOSA | | 42 | 10-130 | | 32 | 10-130 |
| D3-NMeFOSAA | | 68 | 40-170 | M-03 | 43 | 40-170 |
| D5-NEtFOSA | | 35 | 10-130 | | 29 | 10-130 |
| D5-NEtFOSAA | | 46 | 25-135 | | 32 | 25-135 |
| D7-NMeFOSE | | 47 | 10-130 | | 36 | 10-130 |
| D9-NEtFOSE | | 40 | 10-130 | | 30 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-018
Description: VRTB-L-S2_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1105 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0307 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 5 | 08/24/2024 2012 | BWS | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | US | 3.6 | 2.1 | 0.79 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 5.7 | M-03 | 3.6 | 1.4 | 0.55 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 2.5 | JM-03 | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.55 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.57 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.0 | M-03 | 0.90 | 0.32 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.1 | M-03 | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | US | 0.90 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.096 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 12 | | 0.90 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 9.2 | | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 150 | M-03 | 0.90 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 14 | | 0.90 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.90 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 3.6 | M-03 | 0.90 | 0.36 | 0.093 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.1 | M-03 | 0.90 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 700 | BM-03 | 4.5 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 23 | M-03 | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.2 | M-03 | 0.90 | 0.68 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 10 | M-03 | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.54 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-018
Description: VRTB-L-S2_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1105
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 75 | 40-200 | | 70 | 40-200 |
| 13C2-6:2FTS | | 74 | 40-200 | M-03 | 63 | 40-200 |
| 13C2-8:2FTS | | 64 | 40-300 | M-03 | 52 | 40-300 |
| 13C2-PFDoA | | 35 | 10-130 | M-03 | 33 | 10-130 |
| 13C2-PFTeDA | | 26 | 10-130 | M-03 | 25 | 10-130 |
| 13C3-HFPO-DA | | 75 | 40-130 | | 74 | 40-130 |
| 13C3-PFBS | | 77 | 40-135 | | 70 | 40-135 |
| 13C3-PFHxS | | 73 | 40-130 | | 75 | 40-130 |
| 13C4-PFBA | | 77 | 5.0-130 | | 76 | 5.0-130 |
| 13C4-PFHpA | | 75 | 40-130 | | 65 | 40-130 |
| 13C5-PFHxA | | 73 | 40-130 | | 71 | 40-130 |
| 13C5-PFPeA | | 76 | 40-130 | | 73 | 40-130 |
| 13C6-PFDA | | 67 | 40-130 | | 56 | 40-130 |
| 13C7-PFUnA | | 48 | 30-130 | M-03 | 46 | 30-130 |
| 13C8-PFOA | | 78 | 40-130 | | 76 | 40-130 |
| 13C8-PFOS | | 67 | 40-130 | | 64 | 40-130 |
| 13C8-PFOSA | | 51 | 40-130 | | 47 | 40-130 |
| 13C9-PFNA | | 76 | 40-130 | | 79 | 40-130 |
| D3-NMeFOSA | | 32 | 10-130 | M-03 | 30 | 10-130 |
| D3-NMeFOSAA | | 49 | 40-170 | N | 39 | 40-170 |
| D5-NEtFOSA | | 27 | 10-130 | | 22 | 10-130 |
| D5-NEtFOSAA | | 37 | 25-135 | | 29 | 25-135 |
| D7-NMeFOSE | | 34 | 10-130 | | 31 | 10-130 |
| D9-NEtFOSE | | 28 | 10-130 | | 25 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-019
Description: VRTB-L-Y3_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1205 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0334 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 5 | 08/24/2024 2022 | BWS | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.77 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 41 | M-03 | 3.5 | 1.3 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 5.6 | M-03 | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 4.7 | M-03 | 0.88 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 8.4 | | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.094 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 13 | | 0.88 | 0.33 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 13 | | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 120 | | 0.88 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 14 | M-03 | 0.88 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.31 | JM-03 | 0.88 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 4.8 | M-03 | 0.88 | 0.35 | 0.091 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.0 | M-03 | 0.88 | 0.35 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 990 | BM-03 | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 22 | M-03 | 0.88 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 7.1 | M-03 | 0.88 | 0.66 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 12 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-019
Description: VRTB-L-Y3_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1205
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 69 | 40-200 | M-03 | 65 | 40-200 |
| 13C2-6:2FTS | | 66 | 40-200 | | 68 | 40-200 |
| 13C2-8:2FTS | | 53 | 40-300 | | 50 | 40-300 |
| 13C2-PFDoA | | 44 | 10-130 | | 41 | 10-130 |
| 13C2-PFTeDA | | 40 | 10-130 | | 38 | 10-130 |
| 13C3-HFPO-DA | | 74 | 40-130 | | 69 | 40-130 |
| 13C3-PFBS | | 74 | 40-135 | | 68 | 40-135 |
| 13C3-PFHxS | | 69 | 40-130 | | 62 | 40-130 |
| 13C4-PFBA | | 75 | 5.0-130 | | 75 | 5.0-130 |
| 13C4-PFHpA | | 80 | 40-130 | | 73 | 40-130 |
| 13C5-PFHxA | | 72 | 40-130 | | 74 | 40-130 |
| 13C5-PFPeA | | 77 | 40-130 | | 74 | 40-130 |
| 13C6-PFDA | | 64 | 40-130 | | 58 | 40-130 |
| 13C7-PFUnA | | 52 | 30-130 | | 47 | 30-130 |
| 13C8-PFOA | | 73 | 40-130 | | 75 | 40-130 |
| 13C8-PFOS | | 63 | 40-130 | | 72 | 40-130 |
| 13C8-PFOSA | | 57 | 40-130 | | 56 | 40-130 |
| 13C9-PFNA | | 73 | 40-130 | | 64 | 40-130 |
| D3-NMeFOSA | | 36 | 10-130 | | 32 | 10-130 |
| D3-NMeFOSAA | | 52 | 40-170 | | 40 | 40-170 |
| D5-NEtFOSA | | 33 | 10-130 | | 31 | 10-130 |
| D5-NEtFOSAA | | 43 | 25-135 | | 40 | 25-135 |
| D7-NMeFOSE | | 45 | 10-130 | | 42 | 10-130 |
| D9-NEtFOSE | | 42 | 10-130 | | 39 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-020
Description: DUP-01_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0344 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 2050 | BWS | 08/09/2024 1707 | 15908 |
| 3 | 1633 | 1633 | 1 | 08/27/2024 0333 | ARC2 | 08/23/2024 1526 | 16856 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.76 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.58 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 69 | M-03 | 3.5 | 1.3 | 0.53 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.34 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 82 | | 4.3 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.86 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.25 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.7 | U | 8.7 | 1.7 | 0.53 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.7 | U | 8.7 | 1.7 | 0.55 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.1 | U | 1.7 | 1.1 | 0.50 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.94 | U | 1.7 | 0.94 | 0.31 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.54 | U | 1.7 | 0.54 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.1 | U | 1.7 | 1.1 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 30 | | 0.87 | 0.30 | 0.081 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 39 | M-03 | 3.5 | 1.4 | 0.44 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.87 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.52 | JM-03 | 0.87 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | U | 0.87 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.093 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 310 | | 0.87 | 0.33 | 0.16 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 94 | | 0.87 | 0.70 | 0.18 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.6 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1800 | E | 0.87 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 210 | | 0.87 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.4 | M-03 | 0.87 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 94 | M-03 | 0.87 | 0.35 | 0.089 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 5.5 | M-03 | 0.87 | 0.35 | 0.17 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 29000 | BEM-03 | 0.87 | 0.64 | 0.21 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 220 | M-03 | 0.87 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 75 | | 0.87 | 0.65 | 0.22 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 88 | M-03 | 1.7 | 0.34 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.7 | U | 4.3 | 1.7 | 0.52 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.23 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.87 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.87 | 0.70 | 0.21 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-020
Description: DUP-01_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 82 | 40-200 | | 61 | 40-200 | H | 80 | 40-200 |
| 13C2-6:2FTS | | 78 | 40-200 | M-03 | 52 | 40-200 | H | 84 | 40-200 |
| 13C2-8:2FTS | | 68 | 40-300 | | 55 | 40-300 | H | 73 | 40-300 |
| 13C2-PFDoA | | 37 | 10-130 | M-03 | 35 | 10-130 | H | 73 | 10-130 |
| 13C2-PFTeDA | | 29 | 10-130 | | 26 | 10-130 | H | 75 | 10-130 |
| 13C3-HFPO-DA | | 67 | 40-130 | | 62 | 40-130 | H | 87 | 40-130 |
| 13C3-PFBS | | 80 | 40-135 | | 61 | 40-135 | H | 85 | 40-135 |
| 13C3-PFHxS | | 69 | 40-130 | | 60 | 40-130 | H | 84 | 40-130 |
| 13C4-PFBA | | 69 | 5.0-130 | | 67 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 66 | 40-130 | | 64 | 40-130 | H | 94 | 40-130 |
| 13C5-PFHxA | | 64 | 40-130 | | 70 | 40-130 | H | 88 | 40-130 |
| 13C5-PFPeA | | 66 | 40-130 | | 71 | 40-130 | H | 89 | 40-130 |
| 13C6-PFDA | | 58 | 40-130 | | 53 | 40-130 | H | 83 | 40-130 |
| 13C7-PFUnA | | 46 | 30-130 | | 43 | 30-130 | H | 76 | 30-130 |
| 13C8-PFOA | | 61 | 40-130 | | 60 | 40-130 | H | 85 | 40-130 |
| 13C8-PFOS | M-03 | 59 | 40-130 | M-03 | 58 | 40-130 | H | 88 | 40-130 |
| 13C8-PFOSA | | 93 | 40-130 | | 54 | 40-130 | H | 87 | 40-130 |
| 13C9-PFNA | | 65 | 40-130 | M-03 | 53 | 40-130 | H | 83 | 40-130 |
| D3-NMeFOSA | | 57 | 10-130 | M-03 | 29 | 10-130 | H | 61 | 10-130 |
| D3-NMeFOSAA | | 102 | 40-170 | M-03 | 55 | 40-170 | H | 79 | 40-170 |
| D5-NEtFOSA | | 47 | 10-130 | | 24 | 10-130 | H | 61 | 10-130 |
| D5-NEtFOSAA | | 63 | 25-135 | M-03 | 45 | 25-135 | H | 80 | 25-135 |
| D7-NMeFOSE | | 72 | 10-130 | | 37 | 10-130 | H | 73 | 10-130 |
| D9-NEtFOSE | | 63 | 10-130 | | 31 | 10-130 | H | 70 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-020
Description: DUP-01_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0344 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 2050 | BWS | 08/09/2024 1707 | 15908 |
| 3 | 1633 | 1633 | 1 | 08/27/2024 0333 | ARC2 | 08/23/2024 1526 | 16856 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 20 | U | 35 | 20 | 7.6 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 19 | U | 35 | 19 | 5.8 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 20 | U | 35 | 20 | 5.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 64 | M-03 | 35 | 13 | 5.3 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 13 | U | 35 | 13 | 3.4 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 110 | | 43 | 40 | 18 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 88 | U | 220 | 88 | 37 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 21 | U | 35 | 21 | 8.6 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.5 | U | 8.7 | 3.5 | 1.1 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.0 | U | 8.7 | 7.0 | 2.5 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 17 | U | 87 | 17 | 5.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.0 | U | 8.7 | 7.0 | 1.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.0 | U | 8.7 | 7.0 | 2.6 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 17 | U | 87 | 17 | 5.5 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 11 | U | 17 | 11 | 5.0 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 9.4 | U | 17 | 9.4 | 3.1 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 5.4 | U | 17 | 5.4 | 1.6 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 11 | U | 17 | 11 | 3.4 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 33 | | 8.7 | 3.0 | 0.81 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 40 | M-09 | 35 | 14 | 4.4 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.4 | U | 8.7 | 3.4 | 1.4 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.5 | U | 8.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.4 | U | 8.7 | 3.4 | 1.3 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.5 | U | 8.7 | 3.5 | 0.93 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 180 | | 8.7 | 3.3 | 1.6 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 100 | | 8.7 | 7.0 | 1.8 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 88 | U | 220 | 88 | 36 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2100 | M-03 | 8.7 | 6.4 | 1.6 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 200 | | 8.7 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.3 | UM-03 | 8.7 | 3.3 | 1.3 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 100 | | 8.7 | 3.5 | 0.89 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 5.6 | JM-03 | 8.7 | 3.5 | 1.7 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 27000 | BEM-03 | 8.7 | 6.4 | 2.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 210 | M-03 | 8.7 | 7.0 | 1.8 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 76 | | 8.7 | 6.5 | 2.2 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 79 | M-09 | 17 | 3.4 | 1.6 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 17 | U | 43 | 17 | 5.2 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.0 | U | 8.7 | 7.0 | 2.3 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.5 | U | 8.7 | 3.5 | 1.7 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.0 | U | 8.7 | 7.0 | 2.1 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-020
Description: DUP-01_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 82 | 40-200 | | 61 | 40-200 | H | 80 | 40-200 |
| 13C2-6:2FTS | | 78 | 40-200 | M-03 | 52 | 40-200 | H | 84 | 40-200 |
| 13C2-8:2FTS | | 68 | 40-300 | | 55 | 40-300 | H | 73 | 40-300 |
| 13C2-PFDoA | | 37 | 10-130 | M-03 | 35 | 10-130 | H | 73 | 10-130 |
| 13C2-PFTeDA | | 29 | 10-130 | | 26 | 10-130 | H | 75 | 10-130 |
| 13C3-HFPO-DA | | 67 | 40-130 | | 62 | 40-130 | H | 87 | 40-130 |
| 13C3-PFBS | | 80 | 40-135 | | 61 | 40-135 | H | 85 | 40-135 |
| 13C3-PFHxS | | 69 | 40-130 | | 60 | 40-130 | H | 84 | 40-130 |
| 13C4-PFBA | | 69 | 5.0-130 | | 67 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 66 | 40-130 | | 64 | 40-130 | H | 94 | 40-130 |
| 13C5-PFHxA | | 64 | 40-130 | | 70 | 40-130 | H | 88 | 40-130 |
| 13C5-PFPeA | | 66 | 40-130 | | 71 | 40-130 | H | 89 | 40-130 |
| 13C6-PFDA | | 58 | 40-130 | | 53 | 40-130 | H | 83 | 40-130 |
| 13C7-PFUnA | | 46 | 30-130 | | 43 | 30-130 | H | 76 | 30-130 |
| 13C8-PFOA | | 61 | 40-130 | | 60 | 40-130 | H | 85 | 40-130 |
| 13C8-PFOS | M-03 | 59 | 40-130 | M-03 | 58 | 40-130 | H | 88 | 40-130 |
| 13C8-PFOSA | | 93 | 40-130 | | 54 | 40-130 | H | 87 | 40-130 |
| 13C9-PFNA | | 65 | 40-130 | M-03 | 53 | 40-130 | H | 83 | 40-130 |
| D3-NMeFOSA | | 57 | 10-130 | M-03 | 29 | 10-130 | H | 61 | 10-130 |
| D3-NMeFOSAA | | 102 | 40-170 | M-03 | 55 | 40-170 | H | 79 | 40-170 |
| D5-NEtFOSA | | 47 | 10-130 | | 24 | 10-130 | H | 61 | 10-130 |
| D5-NEtFOSAA | | 63 | 25-135 | M-03 | 45 | 25-135 | H | 80 | 25-135 |
| D7-NMeFOSE | | 72 | 10-130 | | 37 | 10-130 | H | 73 | 10-130 |
| D9-NEtFOSE | | 63 | 10-130 | | 31 | 10-130 | H | 70 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-020
Description: DUP-01_07162024 | Matrix: Aqueous
Date Sampled: 07/16/2024 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0344 | ARC2 | 08/09/2024 1707 | 15908 |
| 2 | 1633 | 1633 | 10 | 08/24/2024 2050 | BWS | 08/09/2024 1707 | 15908 |
| 3 | 1633 | 1633 | 1 | 08/27/2024 0333 | ARC2 | 08/23/2024 1526 | 16856 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | UH | 400 | 230 | 87 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | UH | 400 | 220 | 67 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | UH | 400 | 230 | 66 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 84 | HJM-03 | 400 | 150 | 61 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | UH | 400 | 150 | 40 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 460 | UH | 500 | 460 | 200 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | UH | 2500 | 1000 | 430 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | UH | 400 | 240 | 99 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | UH | 100 | 40 | 13 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | UH | 1000 | 200 | 61 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | UH | 100 | 80 | 22 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | UH | 1000 | 200 | 63 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | UH | 200 | 130 | 58 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | UH | 200 | 110 | 36 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | UH | 200 | 64 | 18 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | UH | 200 | 130 | 39 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 24 | HJM-03 | 100 | 35 | 9.4 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 160 | UHM-03 | 400 | 160 | 51 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | UH | 100 | 39 | 16 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | UH | 100 | 40 | 14 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | UH | 100 | 39 | 15 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | UH | 100 | 40 | 11 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 98 | HJM-03 | 100 | 38 | 19 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 78 | HJM-03 | 100 | 80 | 21 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | UH | 2500 | 1000 | 420 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1700 | HM-03 | 100 | 73 | 18 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 180 | HM-03 | 100 | 40 | 14 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | UHM-03 | 100 | 38 | 15 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 82 | HJM-03 | 100 | 40 | 10 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 40 | UH | 100 | 40 | 20 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 20000 | HM-03 | 100 | 74 | 25 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 260 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 62 | HJM-03 | 100 | 75 | 26 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 40 | UH | 200 | 40 | 18 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | UH | 500 | 200 | 60 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | UH | 100 | 80 | 27 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | UH | 100 | 40 | 19 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | UH | 100 | 80 | 25 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-020
Description: DUP-01_07162024
Matrix: Aqueous
Date Sampled: 07/16/2024
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 82 | 40-200 | | 61 | 40-200 | H | 80 | 40-200 |
| 13C2-6:2FTS | | 78 | 40-200 | M-03 | 52 | 40-200 | H | 84 | 40-200 |
| 13C2-8:2FTS | | 68 | 40-300 | | 55 | 40-300 | H | 73 | 40-300 |
| 13C2-PFDoA | | 37 | 10-130 | M-03 | 35 | 10-130 | H | 73 | 10-130 |
| 13C2-PFTeDA | | 29 | 10-130 | | 26 | 10-130 | H | 75 | 10-130 |
| 13C3-HFPO-DA | | 67 | 40-130 | | 62 | 40-130 | H | 87 | 40-130 |
| 13C3-PFBS | | 80 | 40-135 | | 61 | 40-135 | H | 85 | 40-135 |
| 13C3-PFHxS | | 69 | 40-130 | | 60 | 40-130 | H | 84 | 40-130 |
| 13C4-PFBA | | 69 | 5.0-130 | | 67 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 66 | 40-130 | | 64 | 40-130 | H | 94 | 40-130 |
| 13C5-PFHxA | | 64 | 40-130 | | 70 | 40-130 | H | 88 | 40-130 |
| 13C5-PFPeA | | 66 | 40-130 | | 71 | 40-130 | H | 89 | 40-130 |
| 13C6-PFDA | | 58 | 40-130 | | 53 | 40-130 | H | 83 | 40-130 |
| 13C7-PFUnA | | 46 | 30-130 | | 43 | 30-130 | H | 76 | 30-130 |
| 13C8-PFOA | | 61 | 40-130 | | 60 | 40-130 | H | 85 | 40-130 |
| 13C8-PFOS | M-03 | 59 | 40-130 | M-03 | 58 | 40-130 | H | 88 | 40-130 |
| 13C8-PFOSA | | 93 | 40-130 | | 54 | 40-130 | H | 87 | 40-130 |
| 13C9-PFNA | | 65 | 40-130 | M-03 | 53 | 40-130 | H | 83 | 40-130 |
| D3-NMeFOSA | | 57 | 10-130 | M-03 | 29 | 10-130 | H | 61 | 10-130 |
| D3-NMeFOSAA | | 102 | 40-170 | M-03 | 55 | 40-170 | H | 79 | 40-170 |
| D5-NEtFOSA | | 47 | 10-130 | | 24 | 10-130 | H | 61 | 10-130 |
| D5-NEtFOSAA | | 63 | 25-135 | M-03 | 45 | 25-135 | H | 80 | 25-135 |
| D7-NMeFOSE | | 72 | 10-130 | | 37 | 10-130 | H | 73 | 10-130 |
| D9-NEtFOSE | | 63 | 10-130 | | 31 | 10-130 | H | 70 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-021
Description: VRTB-L-G4_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1305 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/23/2024 0353 | ARC2 | 08/09/2024 1707 | 15908 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.6 | JM-03 | 3.5 | 1.3 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.9 | M-03 | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 6.9 | | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 9.3 | | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 7.0 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 130 | | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 12 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 2.6 | M-03 | 0.89 | 0.36 | 0.091 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 440 | BM-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 17 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.0 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 8.8 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-021
Description: VRTB-L-G4_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1305
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 82 | 40-200 |
| 13C2-6:2FTS | | 86 | 40-200 |
| 13C2-8:2FTS | | 77 | 40-300 |
| 13C2-PFDoA | | 47 | 10-130 |
| 13C2-PFTeDA | | 30 | 10-130 |
| 13C3-HFPO-DA | | 82 | 40-130 |
| 13C3-PFBS | | 85 | 40-135 |
| 13C3-PFHxS | | 82 | 40-130 |
| 13C4-PFBA | | 83 | 5.0-130 |
| 13C4-PFHpA | | 88 | 40-130 |
| 13C5-PFHxA | | 80 | 40-130 |
| 13C5-PFPeA | | 86 | 40-130 |
| 13C6-PFDA | | 73 | 40-130 |
| 13C7-PFUnA | | 62 | 30-130 |
| 13C8-PFOA | | 87 | 40-130 |
| 13C8-PFOS | | 83 | 40-130 |
| 13C8-PFOSA | | 61 | 40-130 |
| 13C9-PFNA | | 79 | 40-130 |
| D3-NMeFOSA | | 28 | 10-130 |
| D3-NMeFOSAA | | 67 | 40-170 |
| D5-NEtFOSA | | 25 | 10-130 |
| D5-NEtFOSAA | M-03 | 56 | 25-135 |
| D7-NMeFOSE | | 38 | 10-130 |
| D9-NEtFOSE | | 32 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-022
Description: VRTB-L-M5_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1435 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1516 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 1 | 08/22/2024 0550 | ARC2 | 08/16/2024 1008 | 16352 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 45 | | 3.6 | 1.4 | 0.55 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 58 | | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.55 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 4.3 | | 0.89 | 0.31 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 25 | | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.56 | JM-03 | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 85 | | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 61 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 490 | | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 53 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.52 | JM-03 | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 82 | | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.2 | M-03 | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 13000 | EM-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 100 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.9 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 58 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-022
Description: VRTB-L-M5_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1435
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 84 | 40-200 | H | 78 | 40-200 |
| 13C2-6:2FTS | | 74 | 40-200 | H | 73 | 40-200 |
| 13C2-8:2FTS | | 65 | 40-300 | H | 75 | 40-300 |
| 13C2-PFDoA | | 52 | 10-130 | H | 64 | 10-130 |
| 13C2-PFTeDA | | 44 | 10-130 | H | 61 | 10-130 |
| 13C3-HFPO-DA | | 81 | 40-130 | H | 80 | 40-130 |
| 13C3-PFBS | | 91 | 40-135 | H | 79 | 40-135 |
| 13C3-PFHxS | | 84 | 40-130 | H | 80 | 40-130 |
| 13C4-PFBA | | 26 | 5.0-130 | H | 80 | 5.0-130 |
| 13C4-PFHpA | | 82 | 40-130 | H | 78 | 40-130 |
| 13C5-PFHxA | | 81 | 40-130 | H | 77 | 40-130 |
| 13C5-PFPeA | | 81 | 40-130 | H | 80 | 40-130 |
| 13C6-PFDA | | 67 | 40-130 | H | 74 | 40-130 |
| 13C7-PFUnA | | 57 | 30-130 | H | 67 | 30-130 |
| 13C8-PFOA | | 80 | 40-130 | H | 71 | 40-130 |
| 13C8-PFOS | | 69 | 40-130 | H | 76 | 40-130 |
| 13C8-PFOSA | | 129 | 40-130 | H | 78 | 40-130 |
| 13C9-PFNA | | 76 | 40-130 | H | 82 | 40-130 |
| D3-NMeFOSA | | 88 | 10-130 | H | 47 | 10-130 |
| D3-NMeFOSAA | | 101 | 40-170 | H | 76 | 40-170 |
| D5-NEtFOSA | | 81 | 10-130 | H | 45 | 10-130 |
| D5-NEtFOSAA | | 79 | 25-135 | H | 68 | 25-135 |
| D7-NMeFOSE | | 79 | 10-130 | H | 62 | 10-130 |
| D9-NEtFOSE | | 71 | 10-130 | H | 61 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-022
Description: VRTB-L-M5_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1435 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1516 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 1 | 08/22/2024 0550 | ARC2 | 08/16/2024 1008 | 16352 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 120 | UH | 200 | 120 | 44 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 110 | UH | 200 | 110 | 33 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 120 | UH | 200 | 120 | 33 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 44 | HJM-03 | 200 | 75 | 30 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 75 | UH | 200 | 75 | 20 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 230 | UH | 250 | 230 | 100 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 120 | UH | 200 | 120 | 50 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 20 | UH | 50 | 20 | 6.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 100 | UH | 500 | 100 | 31 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 40 | UH | 50 | 40 | 11 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 40 | UH | 50 | 40 | 15 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 100 | UH | 500 | 100 | 32 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 65 | UH | 100 | 65 | 29 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 55 | UH | 100 | 55 | 18 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 32 | UH | 100 | 32 | 9.2 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 65 | UH | 100 | 65 | 19 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 18 | UH | 50 | 18 | 4.7 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 80 | UH | 200 | 80 | 26 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 20 | UH | 50 | 20 | 8.2 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 20 | UH | 50 | 20 | 6.8 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 20 | UH | 50 | 20 | 7.7 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 20 | UH | 50 | 20 | 5.3 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 35 | HJM-03 | 50 | 19 | 9.5 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 62 | HM-03 | 50 | 40 | 11 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 520 | UH | 1300 | 520 | 210 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 460 | HM-03 | 50 | 37 | 9.2 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 56 | HM-03 | 50 | 20 | 7.1 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 19 | UH | 50 | 19 | 7.3 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 71 | HM-03 | 50 | 20 | 5.2 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 20 | UH | 50 | 20 | 9.9 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 10000 | HM-03 | 50 | 37 | 12 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 110 | HM-03 | 50 | 40 | 10 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 38 | UH | 50 | 38 | 13 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 20 | UH | 100 | 20 | 9.2 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 100 | UH | 250 | 100 | 30 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 40 | UH | 50 | 40 | 13 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 20 | UH | 50 | 20 | 9.7 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 40 | UH | 50 | 40 | 12 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-022
Description: VRTB-L-M5_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1435
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 84 | 40-200 | H | 78 | 40-200 |
| 13C2-6:2FTS | | 74 | 40-200 | H | 73 | 40-200 |
| 13C2-8:2FTS | | 65 | 40-300 | H | 75 | 40-300 |
| 13C2-PFDoA | | 52 | 10-130 | H | 64 | 10-130 |
| 13C2-PFTeDA | | 44 | 10-130 | H | 61 | 10-130 |
| 13C3-HFPO-DA | | 81 | 40-130 | H | 80 | 40-130 |
| 13C3-PFBS | | 91 | 40-135 | H | 79 | 40-135 |
| 13C3-PFHxS | | 84 | 40-130 | H | 80 | 40-130 |
| 13C4-PFBA | | 26 | 5.0-130 | H | 80 | 5.0-130 |
| 13C4-PFHpA | | 82 | 40-130 | H | 78 | 40-130 |
| 13C5-PFHxA | | 81 | 40-130 | H | 77 | 40-130 |
| 13C5-PFPeA | | 81 | 40-130 | H | 80 | 40-130 |
| 13C6-PFDA | | 67 | 40-130 | H | 74 | 40-130 |
| 13C7-PFUnA | | 57 | 30-130 | H | 67 | 30-130 |
| 13C8-PFOA | | 80 | 40-130 | H | 71 | 40-130 |
| 13C8-PFOS | | 69 | 40-130 | H | 76 | 40-130 |
| 13C8-PFOSA | | 129 | 40-130 | H | 78 | 40-130 |
| 13C9-PFNA | | 76 | 40-130 | H | 82 | 40-130 |
| D3-NMeFOSA | | 88 | 10-130 | H | 47 | 10-130 |
| D3-NMeFOSAA | | 101 | 40-170 | H | 76 | 40-170 |
| D5-NEtFOSA | | 81 | 10-130 | H | 45 | 10-130 |
| D5-NEtFOSAA | | 79 | 25-135 | H | 68 | 25-135 |
| D7-NMeFOSE | | 79 | 10-130 | H | 62 | 10-130 |
| D9-NEtFOSE | | 71 | 10-130 | H | 61 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-023
Description: VRTB-L-06_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1520 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1525 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 5 | 08/16/2024 0103 | BWS | 08/10/2024 1144 | 16000 |
| 3 | 1633 | 1633 | 1 | 08/22/2024 0559 | ARC2 | 08/16/2024 1008 | 16352 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.77 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 90 | | 3.5 | 1.3 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 160 | | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.6 | M-03 | 0.88 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 37 | M-03 | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.094 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 140 | | 0.88 | 0.33 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 100 | | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 950 | E | 0.88 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 120 | | 0.88 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.58 | JM-10 | 0.88 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 110 | | 0.88 | 0.35 | 0.091 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.5 | QM-03 | 0.88 | 0.35 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 19000 | EM-03 | 0.88 | 0.65 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 170 | M-03 | 0.88 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 22 | | 0.88 | 0.66 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 100 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-023
Description: VRTB-L-06_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1520 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 90 | 40-200 | | 79 | 40-200 | H | 70 | 40-200 |
| 13C2-6:2FTS | | 82 | 40-200 | | 91 | 40-200 | H | 63 | 40-200 |
| 13C2-8:2FTS | | 76 | 40-300 | | 88 | 40-300 | H | 56 | 40-300 |
| 13C2-PFDoA | | 50 | 10-130 | M-03 | 48 | 10-130 | H | 58 | 10-130 |
| 13C2-PFTeDA | | 41 | 10-130 | | 48 | 10-130 | H | 56 | 10-130 |
| 13C3-HFPO-DA | | 87 | 40-130 | | 80 | 40-130 | H | 74 | 40-130 |
| 13C3-PFBS | | 101 | 40-135 | | 85 | 40-135 | H | 75 | 40-135 |
| 13C3-PFHxS | | 87 | 40-130 | | 87 | 40-130 | H | 76 | 40-130 |
| 13C4-PFBA | | 23 | 5.0-130 | | 23 | 5.0-130 | H | 73 | 5.0-130 |
| 13C4-PFHpA | | 88 | 40-130 | | 85 | 40-130 | H | 74 | 40-130 |
| 13C5-PFHxA | | 83 | 40-130 | | 78 | 40-130 | H | 70 | 40-130 |
| 13C5-PFPeA | | 85 | 40-130 | | 78 | 40-130 | H | 76 | 40-130 |
| 13C6-PFDA | | 75 | 40-130 | | 83 | 40-130 | H | 69 | 40-130 |
| 13C7-PFUnA | | 62 | 30-130 | | 68 | 30-130 | H | 62 | 30-130 |
| 13C8-PFOA | | 84 | 40-130 | | 97 | 40-130 | H | 70 | 40-130 |
| 13C8-PFOS | M-03 | 93 | 40-130 | M-03 | 80 | 40-130 | H | 71 | 40-130 |
| 13C8-PFOSA | N | 170 | 40-130 | | 106 | 40-130 | H | 74 | 40-130 |
| 13C9-PFNA | | 88 | 40-130 | | 86 | 40-130 | H | 64 | 40-130 |
| D3-NMeFOSA | | 108 | 10-130 | | 75 | 10-130 | H | 44 | 10-130 |
| D3-NMeFOSAA | | 121 | 40-170 | | 95 | 40-170 | H | 67 | 40-170 |
| D5-NEtFOSA | | 95 | 10-130 | | 64 | 10-130 | H | 42 | 10-130 |
| D5-NEtFOSAA | M-03 | 83 | 25-135 | | 65 | 25-135 | H | 61 | 25-135 |
| D7-NMeFOSE | | 85 | 10-130 | | 59 | 10-130 | H | 57 | 10-130 |
| D9-NEtFOSE | | 76 | 10-130 | | 52 | 10-130 | H | 58 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-023
Description: VRTB-L-06_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1520 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1525 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 5 | 08/16/2024 0103 | BWS | 08/10/2024 1144 | 16000 |
| 3 | 1633 | 1633 | 1 | 08/22/2024 0559 | ARC2 | 08/16/2024 1008 | 16352 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 10 | U | 18 | 10 | 3.9 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 9.9 | U | 18 | 9.9 | 3.0 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 10 | U | 18 | 10 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 66 | | 18 | 6.8 | 2.7 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 6.8 | U | 18 | 6.8 | 1.8 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 140 | | 22 | 20 | 8.9 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 44 | U | 110 | 44 | 19 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 18 | 11 | 4.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.57 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.5 | U | 4.4 | 3.5 | 1.3 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 8.8 | U | 44 | 8.8 | 2.7 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.5 | U | 4.4 | 3.5 | 0.95 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.5 | U | 4.4 | 3.5 | 1.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 8.8 | U | 44 | 8.8 | 2.8 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 5.7 | U | 8.8 | 5.7 | 2.5 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 4.8 | U | 8.8 | 4.8 | 1.6 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 2.8 | U | 8.8 | 2.8 | 0.82 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 5.7 | U | 8.8 | 5.7 | 1.7 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 6.8 | | 4.4 | 1.5 | 0.41 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 42 | M-03 | 18 | 7.2 | 2.3 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.7 | U | 4.4 | 1.7 | 0.73 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.60 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.7 | U | 4.4 | 1.7 | 0.68 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.47 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 96 | | 4.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 110 | | 4.4 | 3.5 | 0.94 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 44 | U | 110 | 44 | 18 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1000 | M-03 | 4.4 | 3.2 | 0.81 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 110 | | 4.4 | 1.8 | 0.63 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.7 | U | 4.4 | 1.7 | 0.64 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 110 | M-03 | 4.4 | 1.8 | 0.46 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.7 | JM-03 | 4.4 | 1.8 | 0.88 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 21000 | EM-03 | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 170 | M-03 | 4.4 | 3.5 | 0.92 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 20 | M-03 | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 110 | | 8.8 | 1.8 | 0.81 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 8.8 | U | 22 | 8.8 | 2.6 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.5 | U | 4.4 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.86 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.5 | U | 4.4 | 3.5 | 1.1 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-023

Description: VRTB-L-06_07172024 | Matrix: Aqueous

Date Sampled: 07/17/2024 1520 | Project Name: ESTCP Vertebrae

Date Received: 07/19/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 90 | 40-200 | | 79 | 40-200 | H | 70 | 40-200 |
| 13C2-6:2FTS | | 82 | 40-200 | | 91 | 40-200 | H | 63 | 40-200 |
| 13C2-8:2FTS | | 76 | 40-300 | | 88 | 40-300 | H | 56 | 40-300 |
| 13C2-PFDoA | | 50 | 10-130 | M-03 | 48 | 10-130 | H | 58 | 10-130 |
| 13C2-PFTeDA | | 41 | 10-130 | | 48 | 10-130 | H | 56 | 10-130 |
| 13C3-HFPO-DA | | 87 | 40-130 | | 80 | 40-130 | H | 74 | 40-130 |
| 13C3-PFBS | | 101 | 40-135 | | 85 | 40-135 | H | 75 | 40-135 |
| 13C3-PFHxS | | 87 | 40-130 | | 87 | 40-130 | H | 76 | 40-130 |
| 13C4-PFBA | | 23 | 5.0-130 | | 23 | 5.0-130 | H | 73 | 5.0-130 |
| 13C4-PFHpA | | 88 | 40-130 | | 85 | 40-130 | H | 74 | 40-130 |
| 13C5-PFHxA | | 83 | 40-130 | | 78 | 40-130 | H | 70 | 40-130 |
| 13C5-PFPeA | | 85 | 40-130 | | 78 | 40-130 | H | 76 | 40-130 |
| 13C6-PFDA | | 75 | 40-130 | | 83 | 40-130 | H | 69 | 40-130 |
| 13C7-PFUnA | | 62 | 30-130 | | 68 | 30-130 | H | 62 | 30-130 |
| 13C8-PFOA | | 84 | 40-130 | | 97 | 40-130 | H | 70 | 40-130 |
| 13C8-PFOS | M-03 | 93 | 40-130 | M-03 | 80 | 40-130 | H | 71 | 40-130 |
| 13C8-PFOSA | N | 170 | 40-130 | | 106 | 40-130 | H | 74 | 40-130 |
| 13C9-PFNA | | 88 | 40-130 | | 86 | 40-130 | H | 64 | 40-130 |
| D3-NMeFOSA | | 108 | 10-130 | | 75 | 10-130 | H | 44 | 10-130 |
| D3-NMeFOSAA | | 121 | 40-170 | | 95 | 40-170 | H | 67 | 40-170 |
| D5-NEtFOSA | | 95 | 10-130 | | 64 | 10-130 | H | 42 | 10-130 |
| D5-NEtFOSAA | M-03 | 83 | 25-135 | | 65 | 25-135 | H | 61 | 25-135 |
| D7-NMeFOSE | | 85 | 10-130 | | 59 | 10-130 | H | 57 | 10-130 |
| D9-NEtFOSE | | 76 | 10-130 | | 52 | 10-130 | H | 58 | 10-130 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-023
Description: VRTB-L-06_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1520
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1525 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 5 | 08/16/2024 0103 | BWS | 08/10/2024 1144 | 16000 |
| 3 | 1633 | 1633 | 1 | 08/22/2024 0559 | ARC2 | 08/16/2024 1008 | 16352 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | UH | 400 | 230 | 87 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | UH | 400 | 220 | 67 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | UH | 400 | 230 | 66 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 98 | HJM-03 | 400 | 150 | 61 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | UH | 400 | 150 | 40 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 460 | UH | 500 | 460 | 200 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | UH | 2500 | 1000 | 430 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | UH | 400 | 240 | 99 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | UH | 100 | 40 | 13 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | UH | 1000 | 200 | 61 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | UH | 100 | 80 | 22 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | UH | 1000 | 200 | 63 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | UH | 200 | 130 | 58 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | UH | 200 | 110 | 36 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | UH | 200 | 64 | 18 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | UH | 200 | 130 | 39 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 35 | UH | 100 | 35 | 9.4 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 160 | UHM-03 | 400 | 160 | 51 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | UH | 100 | 39 | 16 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | UH | 100 | 40 | 14 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | UH | 100 | 39 | 15 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | UH | 100 | 40 | 11 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 69 | HJM-03 | 100 | 38 | 19 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 110 | H | 100 | 80 | 21 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | UH | 2500 | 1000 | 420 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 930 | HM-03 | 100 | 73 | 18 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 120 | HM-03 | 100 | 40 | 14 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | UH | 100 | 38 | 15 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 120 | H | 100 | 40 | 10 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 40 | UH | 100 | 40 | 20 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 17000 | HM-03 | 100 | 74 | 25 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 130 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 75 | UH | 100 | 75 | 26 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 40 | UH | 200 | 40 | 18 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | UH | 500 | 200 | 60 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | UH | 100 | 80 | 27 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | UH | 100 | 40 | 19 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | UH | 100 | 80 | 25 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-023
Description: VRTB-L-06_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1520 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 90 | 40-200 | | 79 | 40-200 | H | 70 | 40-200 |
| 13C2-6:2FTS | | 82 | 40-200 | | 91 | 40-200 | H | 63 | 40-200 |
| 13C2-8:2FTS | | 76 | 40-300 | | 88 | 40-300 | H | 56 | 40-300 |
| 13C2-PFDoA | | 50 | 10-130 | M-03 | 48 | 10-130 | H | 58 | 10-130 |
| 13C2-PFTeDA | | 41 | 10-130 | | 48 | 10-130 | H | 56 | 10-130 |
| 13C3-HFPO-DA | | 87 | 40-130 | | 80 | 40-130 | H | 74 | 40-130 |
| 13C3-PFBS | | 101 | 40-135 | | 85 | 40-135 | H | 75 | 40-135 |
| 13C3-PFHxS | | 87 | 40-130 | | 87 | 40-130 | H | 76 | 40-130 |
| 13C4-PFBA | | 23 | 5.0-130 | | 23 | 5.0-130 | H | 73 | 5.0-130 |
| 13C4-PFHpA | | 88 | 40-130 | | 85 | 40-130 | H | 74 | 40-130 |
| 13C5-PFHxA | | 83 | 40-130 | | 78 | 40-130 | H | 70 | 40-130 |
| 13C5-PFPeA | | 85 | 40-130 | | 78 | 40-130 | H | 76 | 40-130 |
| 13C6-PFDA | | 75 | 40-130 | | 83 | 40-130 | H | 69 | 40-130 |
| 13C7-PFUnA | | 62 | 30-130 | | 68 | 30-130 | H | 62 | 30-130 |
| 13C8-PFOA | | 84 | 40-130 | | 97 | 40-130 | H | 70 | 40-130 |
| 13C8-PFOS | M-03 | 93 | 40-130 | M-03 | 80 | 40-130 | H | 71 | 40-130 |
| 13C8-PFOSA | N | 170 | 40-130 | | 106 | 40-130 | H | 74 | 40-130 |
| 13C9-PFNA | | 88 | 40-130 | | 86 | 40-130 | H | 64 | 40-130 |
| D3-NMeFOSA | | 108 | 10-130 | | 75 | 10-130 | H | 44 | 10-130 |
| D3-NMeFOSAA | | 121 | 40-170 | | 95 | 40-170 | H | 67 | 40-170 |
| D5-NEtFOSA | | 95 | 10-130 | | 64 | 10-130 | H | 42 | 10-130 |
| D5-NEtFOSAA | M-03 | 83 | 25-135 | | 65 | 25-135 | H | 61 | 25-135 |
| D7-NMeFOSE | | 85 | 10-130 | | 59 | 10-130 | H | 57 | 10-130 |
| D9-NEtFOSE | | 76 | 10-130 | | 52 | 10-130 | H | 58 | 10-130 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-024
Description: VRTB-L-P7_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1615
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1535 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 5 | 08/16/2024 0113 | BWS | 08/10/2024 1144 | 16000 |
| 3 | 1633 | 1633 | 1 | 08/22/2024 1154 | ARC2 | 08/16/2024 1008 | 16352 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.77 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 1.9 | U | 3.5 | 1.9 | 0.59 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.0 | U | 3.5 | 2.0 | 0.58 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 47 | M-03 | 3.5 | 1.3 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.3 | U | 3.5 | 1.3 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 140 | | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.1 | U | 3.5 | 2.1 | 0.87 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.8 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.34 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 10 | | 0.88 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 54 | M-03 | 3.5 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.74 | JM-03 | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.34 | U | 0.88 | 0.34 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.094 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 160 | | 0.88 | 0.33 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 160 | | 0.88 | 0.70 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1300 | E | 0.88 | 0.64 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 170 | | 0.88 | 0.35 | 0.12 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.49 | JM-03 | 0.88 | 0.33 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 87 | | 0.88 | 0.35 | 0.091 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.3 | QM-03 | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 19000 | EM-03 | 0.88 | 0.65 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 240 | M-03 | 0.88 | 0.70 | 0.18 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 35 | | 0.88 | 0.66 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 150 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.1 | JM-03 | 4.4 | 1.8 | 0.52 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.35 | U | 0.88 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.70 | U | 0.88 | 0.70 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-024
Description: VRTB-L-P7_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1615
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 78 | 40-200 | | 81 | 40-200 | H | 88 | 40-200 |
| 13C2-6:2FTS | | 81 | 40-200 | | 80 | 40-200 | H | 83 | 40-200 |
| 13C2-8:2FTS | | 71 | 40-300 | | 81 | 40-300 | H | 80 | 40-300 |
| 13C2-PFDoA | | 53 | 10-130 | | 61 | 10-130 | H | 74 | 10-130 |
| 13C2-PFTeDA | | 34 | 10-130 | | 38 | 10-130 | H | 65 | 10-130 |
| 13C3-HFPO-DA | | 74 | 40-130 | | 80 | 40-130 | H | 83 | 40-130 |
| 13C3-PFBS | | 87 | 40-135 | M-03 | 81 | 40-135 | H | 90 | 40-135 |
| 13C3-PFHxS | | 76 | 40-130 | | 78 | 40-130 | H | 85 | 40-130 |
| 13C4-PFBA | | 15 | 5.0-130 | | 15 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 79 | 40-130 | | 77 | 40-130 | H | 86 | 40-130 |
| 13C5-PFHxA | | 77 | 40-130 | | 79 | 40-130 | H | 82 | 40-130 |
| 13C5-PFPeA | | 70 | 40-130 | | 69 | 40-130 | H | 85 | 40-130 |
| 13C6-PFDA | | 63 | 40-130 | | 72 | 40-130 | H | 81 | 40-130 |
| 13C7-PFUnA | | 62 | 30-130 | | 73 | 30-130 | H | 70 | 30-130 |
| 13C8-PFOA | | 68 | 40-130 | | 72 | 40-130 | H | 69 | 40-130 |
| 13C8-PFOS | | 74 | 40-130 | | 71 | 40-130 | H | 80 | 40-130 |
| 13C8-PFOSA | N | 133 | 40-130 | | 93 | 40-130 | H | 77 | 40-130 |
| 13C9-PFNA | | 73 | 40-130 | | 85 | 40-130 | H | 82 | 40-130 |
| D3-NMeFOSA | | 88 | 10-130 | | 67 | 10-130 | H | 48 | 10-130 |
| D3-NMeFOSAA | | 110 | 40-170 | | 80 | 40-170 | H | 76 | 40-170 |
| D5-NEtFOSA | | 77 | 10-130 | | 64 | 10-130 | H | 46 | 10-130 |
| D5-NEtFOSAA | | 85 | 25-135 | | 72 | 25-135 | H | 69 | 25-135 |
| D7-NMeFOSE | | 68 | 10-130 | | 55 | 10-130 | H | 61 | 10-130 |
| D9-NEtFOSE | | 51 | 10-130 | | 43 | 10-130 | H | 60 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-024
Description: VRTB-L-P7_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1615 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1535 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 5 | 08/16/2024 0113 | BWS | 08/10/2024 1144 | 16000 |
| 3 | 1633 | 1633 | 1 | 08/22/2024 1154 | ARC2 | 08/16/2024 1008 | 16352 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 10 | U | 18 | 10 | 3.8 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 9.9 | U | 18 | 9.9 | 2.9 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 10 | U | 18 | 10 | 2.9 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 41 | M-03 | 18 | 6.8 | 2.7 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 6.8 | U | 18 | 6.8 | 1.7 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 160 | | 22 | 20 | 8.9 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 44 | U | 110 | 44 | 19 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 11 | U | 18 | 11 | 4.4 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.57 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 3.5 | U | 4.4 | 3.5 | 1.3 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 8.8 | U | 44 | 8.8 | 2.7 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 3.5 | U | 4.4 | 3.5 | 0.95 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 3.5 | U | 4.4 | 3.5 | 1.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 8.8 | U | 44 | 8.8 | 2.8 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 5.7 | U | 8.8 | 5.7 | 2.5 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 4.8 | U | 8.8 | 4.8 | 1.6 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 2.8 | U | 8.8 | 2.8 | 0.81 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 5.7 | U | 8.8 | 5.7 | 1.7 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 10 | | 4.4 | 1.5 | 0.41 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 59 | M-03 | 18 | 7.2 | 2.2 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 1.7 | U | 4.4 | 1.7 | 0.72 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.59 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 1.7 | U | 4.4 | 1.7 | 0.68 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.47 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 110 | | 4.4 | 1.7 | 0.84 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 170 | | 4.4 | 3.5 | 0.93 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 44 | U | 110 | 44 | 18 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1500 | M-03 | 4.4 | 3.2 | 0.81 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 160 | | 4.4 | 1.8 | 0.62 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.7 | U | 4.4 | 1.7 | 0.64 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 95 | M-03 | 4.4 | 1.8 | 0.45 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.87 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 19000 | EM-03 | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 250 | M-03 | 4.4 | 3.5 | 0.92 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 32 | | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 150 | | 8.8 | 1.8 | 0.81 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 8.8 | U | 22 | 8.8 | 2.6 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 3.5 | U | 4.4 | 3.5 | 1.2 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.85 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 3.5 | U | 4.4 | 3.5 | 1.1 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-024
Description: VRTB-L-P7_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1615
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 78 | 40-200 | | 81 | 40-200 | H | 88 | 40-200 |
| 13C2-6:2FTS | | 81 | 40-200 | | 80 | 40-200 | H | 83 | 40-200 |
| 13C2-8:2FTS | | 71 | 40-300 | | 81 | 40-300 | H | 80 | 40-300 |
| 13C2-PFDoA | | 53 | 10-130 | | 61 | 10-130 | H | 74 | 10-130 |
| 13C2-PFTeDA | | 34 | 10-130 | | 38 | 10-130 | H | 65 | 10-130 |
| 13C3-HFPO-DA | | 74 | 40-130 | | 80 | 40-130 | H | 83 | 40-130 |
| 13C3-PFBS | | 87 | 40-135 | M-03 | 81 | 40-135 | H | 90 | 40-135 |
| 13C3-PFHxS | | 76 | 40-130 | | 78 | 40-130 | H | 85 | 40-130 |
| 13C4-PFBA | | 15 | 5.0-130 | | 15 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 79 | 40-130 | | 77 | 40-130 | H | 86 | 40-130 |
| 13C5-PFHxA | | 77 | 40-130 | | 79 | 40-130 | H | 82 | 40-130 |
| 13C5-PFPeA | | 70 | 40-130 | | 69 | 40-130 | H | 85 | 40-130 |
| 13C6-PFDA | | 63 | 40-130 | | 72 | 40-130 | H | 81 | 40-130 |
| 13C7-PFUnA | | 62 | 30-130 | | 73 | 30-130 | H | 70 | 30-130 |
| 13C8-PFOA | | 68 | 40-130 | | 72 | 40-130 | H | 69 | 40-130 |
| 13C8-PFOS | | 74 | 40-130 | | 71 | 40-130 | H | 80 | 40-130 |
| 13C8-PFOSA | N | 133 | 40-130 | | 93 | 40-130 | H | 77 | 40-130 |
| 13C9-PFNA | | 73 | 40-130 | | 85 | 40-130 | H | 82 | 40-130 |
| D3-NMeFOSA | | 88 | 10-130 | | 67 | 10-130 | H | 48 | 10-130 |
| D3-NMeFOSAA | | 110 | 40-170 | | 80 | 40-170 | H | 76 | 40-170 |
| D5-NEtFOSA | | 77 | 10-130 | | 64 | 10-130 | H | 46 | 10-130 |
| D5-NEtFOSAA | | 85 | 25-135 | | 72 | 25-135 | H | 69 | 25-135 |
| D7-NMeFOSE | | 68 | 10-130 | | 55 | 10-130 | H | 61 | 10-130 |
| D9-NEtFOSE | | 51 | 10-130 | | 43 | 10-130 | H | 60 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-024
Description: VRTB-L-P7_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1615
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1535 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 5 | 08/16/2024 0113 | BWS | 08/10/2024 1144 | 16000 |
| 3 | 1633 | 1633 | 1 | 08/22/2024 1154 | ARC2 | 08/16/2024 1008 | 16352 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | UH | 400 | 230 | 87 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | UH | 400 | 220 | 67 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | UH | 400 | 230 | 66 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 150 | UHM-03 | 400 | 150 | 61 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | UH | 400 | 150 | 40 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 460 | UH | 500 | 460 | 200 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | UH | 2500 | 1000 | 430 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | UH | 400 | 240 | 99 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | UH | 100 | 40 | 13 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | UH | 1000 | 200 | 61 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | UH | 100 | 80 | 22 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | UH | 1000 | 200 | 63 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | UH | 200 | 130 | 58 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | UH | 200 | 110 | 36 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | UH | 200 | 64 | 18 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | UH | 200 | 130 | 39 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 35 | UH | 100 | 35 | 9.4 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 54 | HJM-03 | 400 | 160 | 51 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | UH | 100 | 39 | 16 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | UH | 100 | 40 | 14 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | UH | 100 | 39 | 15 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | UH | 100 | 40 | 11 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 79 | HJM-03 | 100 | 38 | 19 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 130 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | UH | 2500 | 1000 | 420 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1300 | HM-03 | 100 | 73 | 18 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 160 | H | 100 | 40 | 14 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | UH | 100 | 38 | 15 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 76 | HJM-03 | 100 | 40 | 10 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 40 | UH | 100 | 40 | 20 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 15000 | HM-03 | 100 | 74 | 25 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 280 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 29 | HJM-03 | 100 | 75 | 26 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 130 | HJM-03 | 200 | 40 | 18 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | UH | 500 | 200 | 60 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | UH | 100 | 80 | 27 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | UH | 100 | 40 | 19 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | UH | 100 | 80 | 25 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-024
Description: VRTB-L-P7_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1615
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 78 | 40-200 | | 81 | 40-200 | H | 88 | 40-200 |
| 13C2-6:2FTS | | 81 | 40-200 | | 80 | 40-200 | H | 83 | 40-200 |
| 13C2-8:2FTS | | 71 | 40-300 | | 81 | 40-300 | H | 80 | 40-300 |
| 13C2-PFDoA | | 53 | 10-130 | | 61 | 10-130 | H | 74 | 10-130 |
| 13C2-PFTeDA | | 34 | 10-130 | | 38 | 10-130 | H | 65 | 10-130 |
| 13C3-HFPO-DA | | 74 | 40-130 | | 80 | 40-130 | H | 83 | 40-130 |
| 13C3-PFBS | | 87 | 40-135 | M-03 | 81 | 40-135 | H | 90 | 40-135 |
| 13C3-PFHxS | | 76 | 40-130 | | 78 | 40-130 | H | 85 | 40-130 |
| 13C4-PFBA | | 15 | 5.0-130 | | 15 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 79 | 40-130 | | 77 | 40-130 | H | 86 | 40-130 |
| 13C5-PFHxA | | 77 | 40-130 | | 79 | 40-130 | H | 82 | 40-130 |
| 13C5-PFPeA | | 70 | 40-130 | | 69 | 40-130 | H | 85 | 40-130 |
| 13C6-PFDA | | 63 | 40-130 | | 72 | 40-130 | H | 81 | 40-130 |
| 13C7-PFUnA | | 62 | 30-130 | | 73 | 30-130 | H | 70 | 30-130 |
| 13C8-PFOA | | 68 | 40-130 | | 72 | 40-130 | H | 69 | 40-130 |
| 13C8-PFOS | | 74 | 40-130 | | 71 | 40-130 | H | 80 | 40-130 |
| 13C8-PFOSA | N | 133 | 40-130 | | 93 | 40-130 | H | 77 | 40-130 |
| 13C9-PFNA | | 73 | 40-130 | | 85 | 40-130 | H | 82 | 40-130 |
| D3-NMeFOSA | | 88 | 10-130 | | 67 | 10-130 | H | 48 | 10-130 |
| D3-NMeFOSAA | | 110 | 40-170 | | 80 | 40-170 | H | 76 | 40-170 |
| D5-NEtFOSA | | 77 | 10-130 | | 64 | 10-130 | H | 46 | 10-130 |
| D5-NEtFOSAA | | 85 | 25-135 | | 72 | 25-135 | H | 69 | 25-135 |
| D7-NMeFOSE | | 68 | 10-130 | | 55 | 10-130 | H | 61 | 10-130 |
| D9-NEtFOSE | | 51 | 10-130 | | 43 | 10-130 | H | 60 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-025
Description: VRTB-L-BB8_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 1715 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1544 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 10 | 08/16/2024 0150 | BWS | 08/10/2024 1144 | 16000 |
| 3 | 1633 | 1633 | 1 | 08/22/2024 1204 | ARC2 | 08/16/2024 1008 | 16352 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.79 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.61 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 34 | | 3.6 | 1.4 | 0.55 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 230 | | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.90 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.1 | 1.8 | 0.55 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.1 | 1.8 | 0.57 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 24 | | 0.91 | 0.32 | 0.085 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 49 | M-03 | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.91 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.64 | JM-03 | 0.91 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.91 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.097 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 390 | | 0.91 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 200 | | 0.91 | 0.73 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.8 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2700 | E | 0.91 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 270 | | 0.91 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.48 | JM-03 | 0.91 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 140 | M-03 | 0.91 | 0.36 | 0.093 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 1.4 | QM-03 | 0.91 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 24000 | EM-03 | 0.91 | 0.67 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 390 | M-03 | 0.91 | 0.73 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 100 | M-03 | 0.91 | 0.68 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 160 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.54 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-025

Description: VRTB-L-BB8_07172024 | Matrix: Aqueous

Date Sampled: 07/17/2024 1715 | Project Name: ESTCP Vertebrae

Date Received: 07/19/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 40-200 | | 85 | 40-200 | H | 76 | 40-200 |
| 13C2-6:2FTS | | 101 | 40-200 | | 85 | 40-200 | H | 77 | 40-200 |
| 13C2-8:2FTS | | 85 | 40-300 | | 78 | 40-300 | H | 72 | 40-300 |
| 13C2-PFDoA | | 64 | 10-130 | | 63 | 10-130 | H | 62 | 10-130 |
| 13C2-PFTeDA | | 61 | 10-130 | | 75 | 10-130 | H | 69 | 10-130 |
| 13C3-HFPO-DA | | 85 | 40-130 | | 86 | 40-130 | H | 75 | 40-130 |
| 13C3-PFBS | | 111 | 40-135 | | 85 | 40-135 | H | 83 | 40-135 |
| 13C3-PFHxS | | 82 | 40-130 | | 81 | 40-130 | H | 83 | 40-130 |
| 13C4-PFBA | | 70 | 5.0-130 | | 73 | 5.0-130 | H | 79 | 5.0-130 |
| 13C4-PFHpA | | 84 | 40-130 | | 81 | 40-130 | H | 80 | 40-130 |
| 13C5-PFHxA | | 86 | 40-130 | M-03 | 86 | 40-130 | H | 80 | 40-130 |
| 13C5-PFPeA | | 88 | 40-130 | | 80 | 40-130 | H | 78 | 40-130 |
| 13C6-PFDA | | 74 | 40-130 | | 82 | 40-130 | H | 77 | 40-130 |
| 13C7-PFUnA | | 67 | 30-130 | | 73 | 30-130 | H | 69 | 30-130 |
| 13C8-PFOA | | 83 | 40-130 | | 83 | 40-130 | H | 79 | 40-130 |
| 13C8-PFOS | | 77 | 40-130 | | 81 | 40-130 | H | 77 | 40-130 |
| 13C8-PFOSA | N | 163 | 40-130 | | 91 | 40-130 | H | 80 | 40-130 |
| 13C9-PFNA | | 78 | 40-130 | | 80 | 40-130 | H | 82 | 40-130 |
| D3-NMeFOSA | | 104 | 10-130 | | 63 | 10-130 | H | 52 | 10-130 |
| D3-NMeFOSAA | | 118 | 40-170 | | 79 | 40-170 | H | 76 | 40-170 |
| D5-NEtFOSA | | 95 | 10-130 | | 57 | 10-130 | H | 47 | 10-130 |
| D5-NEtFOSAA | | 89 | 25-135 | | 62 | 25-135 | H | 75 | 25-135 |
| D7-NMeFOSE | | 103 | 10-130 | | 63 | 10-130 | H | 63 | 10-130 |
| D9-NEtFOSE | | 93 | 10-130 | | 60 | 10-130 | H | 65 | 10-130 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-025
Description: VRTB-L-BB8_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1715
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1544 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 10 | 08/16/2024 0150 | BWS | 08/10/2024 1144 | 16000 |
| 3 | 1633 | 1633 | 1 | 08/22/2024 1204 | ARC2 | 08/16/2024 1008 | 16352 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 21 | U | 36 | 21 | 7.9 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 20 | U | 36 | 20 | 6.1 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 21 | U | 36 | 21 | 6.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 36 | M-03 | 36 | 14 | 5.5 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 14 | U | 36 | 14 | 3.6 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 240 | M-03 | 45 | 41 | 18 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 92 | U | 230 | 92 | 39 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 22 | U | 36 | 22 | 9.0 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.6 | U | 9.1 | 3.6 | 1.2 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.3 | U | 9.1 | 7.3 | 2.6 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 18 | U | 91 | 18 | 5.5 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.3 | U | 9.1 | 7.3 | 1.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.3 | U | 9.1 | 7.3 | 2.7 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 18 | U | 91 | 18 | 5.7 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 12 | U | 18 | 12 | 5.2 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 9.9 | U | 18 | 9.9 | 3.3 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 5.8 | U | 18 | 5.8 | 1.7 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 12 | U | 18 | 12 | 3.5 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 25 | | 9.1 | 3.2 | 0.85 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 53 | M-03 | 36 | 14 | 4.6 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.5 | U | 9.1 | 3.5 | 1.5 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.6 | U | 9.1 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.5 | U | 9.1 | 3.5 | 1.4 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.6 | U | 9.1 | 3.6 | 0.97 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 200 | | 9.1 | 3.5 | 1.7 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 210 | | 9.1 | 7.3 | 1.9 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 92 | U | 230 | 92 | 38 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2800 | M-03 | 9.1 | 6.6 | 1.7 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 260 | | 9.1 | 3.6 | 1.3 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.5 | U | 9.1 | 3.5 | 1.3 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 140 | M-03 | 9.1 | 3.6 | 0.93 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.6 | U | 9.1 | 3.6 | 1.8 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 20000 | EM-03 | 9.1 | 6.7 | 2.2 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 460 | M-03 | 9.1 | 7.3 | 1.9 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 79 | M-03 | 9.1 | 6.8 | 2.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 170 | | 18 | 3.6 | 1.7 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 18 | U | 45 | 18 | 5.4 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.3 | U | 9.1 | 7.3 | 2.4 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.6 | U | 9.1 | 3.6 | 1.8 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.3 | U | 9.1 | 7.3 | 2.2 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-025
Description: VRTB-L-BB8_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1715
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 40-200 | | 85 | 40-200 | H | 76 | 40-200 |
| 13C2-6:2FTS | | 101 | 40-200 | | 85 | 40-200 | H | 77 | 40-200 |
| 13C2-8:2FTS | | 85 | 40-300 | | 78 | 40-300 | H | 72 | 40-300 |
| 13C2-PFDoA | | 64 | 10-130 | | 63 | 10-130 | H | 62 | 10-130 |
| 13C2-PFTeDA | | 61 | 10-130 | | 75 | 10-130 | H | 69 | 10-130 |
| 13C3-HFPO-DA | | 85 | 40-130 | | 86 | 40-130 | H | 75 | 40-130 |
| 13C3-PFBS | | 111 | 40-135 | | 85 | 40-135 | H | 83 | 40-135 |
| 13C3-PFHxS | | 82 | 40-130 | | 81 | 40-130 | H | 83 | 40-130 |
| 13C4-PFBA | | 70 | 5.0-130 | | 73 | 5.0-130 | H | 79 | 5.0-130 |
| 13C4-PFHpA | | 84 | 40-130 | | 81 | 40-130 | H | 80 | 40-130 |
| 13C5-PFHxA | | 86 | 40-130 | M-03 | 86 | 40-130 | H | 80 | 40-130 |
| 13C5-PFPeA | | 88 | 40-130 | | 80 | 40-130 | H | 78 | 40-130 |
| 13C6-PFDA | | 74 | 40-130 | | 82 | 40-130 | H | 77 | 40-130 |
| 13C7-PFUnA | | 67 | 30-130 | | 73 | 30-130 | H | 69 | 30-130 |
| 13C8-PFOA | | 83 | 40-130 | | 83 | 40-130 | H | 79 | 40-130 |
| 13C8-PFOS | | 77 | 40-130 | | 81 | 40-130 | H | 77 | 40-130 |
| 13C8-PFOSA | N | 163 | 40-130 | | 91 | 40-130 | H | 80 | 40-130 |
| 13C9-PFNA | | 78 | 40-130 | | 80 | 40-130 | H | 82 | 40-130 |
| D3-NMeFOSA | | 104 | 10-130 | | 63 | 10-130 | H | 52 | 10-130 |
| D3-NMeFOSAA | | 118 | 40-170 | | 79 | 40-170 | H | 76 | 40-170 |
| D5-NEtFOSA | | 95 | 10-130 | | 57 | 10-130 | H | 47 | 10-130 |
| D5-NEtFOSAA | | 89 | 25-135 | | 62 | 25-135 | H | 75 | 25-135 |
| D7-NMeFOSE | | 103 | 10-130 | | 63 | 10-130 | H | 63 | 10-130 |
| D9-NEtFOSE | | 93 | 10-130 | | 60 | 10-130 | H | 65 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-025
Description: VRTB-L-BB8_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024 1715
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1544 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 10 | 08/16/2024 0150 | BWS | 08/10/2024 1144 | 16000 |
| 3 | 1633 | 1633 | 1 | 08/22/2024 1204 | ARC2 | 08/16/2024 1008 | 16352 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | UH | 400 | 230 | 87 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | UH | 400 | 220 | 67 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | UH | 400 | 230 | 66 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 150 | UH | 400 | 150 | 61 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | UH | 400 | 150 | 40 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 460 | UHM-03 | 500 | 460 | 200 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | UH | 2500 | 1000 | 430 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | UH | 400 | 240 | 99 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | UH | 100 | 40 | 13 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | UH | 1000 | 200 | 61 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | UH | 100 | 80 | 22 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | UH | 1000 | 200 | 63 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | UH | 200 | 130 | 58 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | UH | 200 | 110 | 36 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | UH | 200 | 64 | 18 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | UH | 200 | 130 | 39 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 26 | HJM-03 | 100 | 35 | 9.4 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 160 | UHM-03 | 400 | 160 | 51 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | UH | 100 | 39 | 16 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | UH | 100 | 40 | 14 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | UH | 100 | 39 | 15 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | UH | 100 | 40 | 11 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 160 | HM-03 | 100 | 38 | 19 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 200 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | UH | 2500 | 1000 | 420 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2300 | HM-03 | 100 | 73 | 18 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 240 | HM-03 | 100 | 40 | 14 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | UH | 100 | 38 | 15 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 110 | HM-03 | 100 | 40 | 10 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 40 | UH | 100 | 40 | 20 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 17000 | HM-03 | 100 | 74 | 25 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 380 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 68 | HJM-03 | 100 | 75 | 26 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 160 | HJM-10 | 200 | 40 | 18 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | UH | 500 | 200 | 60 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | UH | 100 | 80 | 27 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | UH | 100 | 40 | 19 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | UH | 100 | 80 | 25 | ng/L | 3 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-025

Description: VRTB-L-BB8_07172024 | Matrix: Aqueous

Date Sampled: 07/17/2024 1715 | Project Name: ESTCP Vertebrae

Date Received: 07/19/2024 | Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 40-200 | | 85 | 40-200 | H | 76 | 40-200 |
| 13C2-6:2FTS | | 101 | 40-200 | | 85 | 40-200 | H | 77 | 40-200 |
| 13C2-8:2FTS | | 85 | 40-300 | | 78 | 40-300 | H | 72 | 40-300 |
| 13C2-PFDoA | | 64 | 10-130 | | 63 | 10-130 | H | 62 | 10-130 |
| 13C2-PFTeDA | | 61 | 10-130 | | 75 | 10-130 | H | 69 | 10-130 |
| 13C3-HFPO-DA | | 85 | 40-130 | | 86 | 40-130 | H | 75 | 40-130 |
| 13C3-PFBS | | 111 | 40-135 | | 85 | 40-135 | H | 83 | 40-135 |
| 13C3-PFHxS | | 82 | 40-130 | | 81 | 40-130 | H | 83 | 40-130 |
| 13C4-PFBA | | 70 | 5.0-130 | | 73 | 5.0-130 | H | 79 | 5.0-130 |
| 13C4-PFHpA | | 84 | 40-130 | | 81 | 40-130 | H | 80 | 40-130 |
| 13C5-PFHxA | | 86 | 40-130 | M-03 | 86 | 40-130 | H | 80 | 40-130 |
| 13C5-PFPeA | | 88 | 40-130 | | 80 | 40-130 | H | 78 | 40-130 |
| 13C6-PFDA | | 74 | 40-130 | | 82 | 40-130 | H | 77 | 40-130 |
| 13C7-PFUnA | | 67 | 30-130 | | 73 | 30-130 | H | 69 | 30-130 |
| 13C8-PFOA | | 83 | 40-130 | | 83 | 40-130 | H | 79 | 40-130 |
| 13C8-PFOS | | 77 | 40-130 | | 81 | 40-130 | H | 77 | 40-130 |
| 13C8-PFOSA | N | 163 | 40-130 | | 91 | 40-130 | H | 80 | 40-130 |
| 13C9-PFNA | | 78 | 40-130 | | 80 | 40-130 | H | 82 | 40-130 |
| D3-NMeFOSA | | 104 | 10-130 | | 63 | 10-130 | H | 52 | 10-130 |
| D3-NMeFOSAA | | 118 | 40-170 | | 79 | 40-170 | H | 76 | 40-170 |
| D5-NEtFOSA | | 95 | 10-130 | | 57 | 10-130 | H | 47 | 10-130 |
| D5-NEtFOSAA | | 89 | 25-135 | | 62 | 25-135 | H | 75 | 25-135 |
| D7-NMeFOSE | | 103 | 10-130 | | 63 | 10-130 | H | 63 | 10-130 |
| D9-NEtFOSE | | 93 | 10-130 | | 60 | 10-130 | H | 65 | 10-130 |

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOD | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-026

Description: CMT-VRTB-01_1_07182024 | Matrix: Aqueous

Date Sampled: 07/18/2024 0915 | Project Name: ESTCP Vertebrae

Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/13/2024 1553 | BWS | 08/10/2024 1144 | 16000 |
| 2 | 1633 | 1633 | 5 | 08/16/2024 0218 | BWS | 08/10/2024 1144 | 16000 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.0 | U | 4.4 | 4.0 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.88 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.11 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 21 | | 0.89 | 0.31 | 0.083 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 31 | | 3.6 | 1.4 | 0.45 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 8.0 | M-03 | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 130 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 150 | | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 75 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 4.0 | M-03 | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.25 | JM-03 | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 560 | M-03 | 4.4 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 250 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 6.5 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 75 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.4 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-026
Description: CMT-VRTB-01_1_07182024
Matrix: Aqueous
Date Sampled: 07/18/2024 0915
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 80 | 40-200 | | 85 | 40-200 |
| 13C2-6:2FTS | | 79 | 40-200 | | 84 | 40-200 |
| 13C2-8:2FTS | | 73 | 40-300 | | 85 | 40-300 |
| 13C2-PFDoA | | 76 | 10-130 | | 80 | 10-130 |
| 13C2-PFTeDA | | 71 | 10-130 | | 74 | 10-130 |
| 13C3-HFPO-DA | | 85 | 40-130 | | 93 | 40-130 |
| 13C3-PFBS | | 86 | 40-135 | | 88 | 40-135 |
| 13C3-PFHxS | | 85 | 40-130 | | 80 | 40-130 |
| 13C4-PFBA | | 71 | 5.0-130 | | 71 | 5.0-130 |
| 13C4-PFHpA | | 85 | 40-130 | | 89 | 40-130 |
| 13C5-PFHxA | | 83 | 40-130 | | 85 | 40-130 |
| 13C5-PFPeA | | 91 | 40-130 | | 86 | 40-130 |
| 13C6-PFDA | | 88 | 40-130 | | 100 | 40-130 |
| 13C7-PFUnA | | 79 | 30-130 | | 78 | 30-130 |
| 13C8-PFOA | | 88 | 40-130 | | 73 | 40-130 |
| 13C8-PFOS | | 85 | 40-130 | M-03 | 86 | 40-130 |
| 13C8-PFOSA | | 87 | 40-130 | | 86 | 40-130 |
| 13C9-PFNA | | 85 | 40-130 | | 79 | 40-130 |
| D3-NMeFOSA | | 64 | 10-130 | | 61 | 10-130 |
| D3-NMeFOSAA | | 71 | 40-170 | | 79 | 40-170 |
| D5-NEtFOSA | | 59 | 10-130 | | 63 | 10-130 |
| D5-NEtFOSAA | | 70 | 25-135 | | 72 | 25-135 |
| D7-NMeFOSE | | 56 | 10-130 | | 66 | 10-130 |
| D9-NEtFOSE | | 55 | 10-130 | | 62 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-027
Description: CMT-VRTB-01_2_07182024
Matrix: Aqueous
Date Sampled: 07/18/2024 1005
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/15/2024 1446 | BWS | 08/13/2024 1925 | 16118 |
| 2 | 1633 | 1633 | 10 | 08/17/2024 0933 | BWS | 08/13/2024 1925 | 16118 |
| 3 | 1633 | 1633 | 1 | 08/24/2024 0918 | BWS | 08/20/2024 1708 | 16518 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.80 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.61 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.61 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 59 | | 3.6 | 1.4 | 0.56 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 91 | | 4.6 | 4.2 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 9.2 | U | 23 | 9.2 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.91 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | UQ | 0.91 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.27 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UQ | 9.1 | 1.8 | 0.56 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.73 | UQ | 0.91 | 0.73 | 0.20 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | UQ | 9.1 | 1.8 | 0.58 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.53 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.33 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | UM-03 | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 30 | | 0.91 | 0.32 | 0.086 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 30 | | 3.6 | 1.4 | 0.47 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.91 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.49 | JM-03 | 0.91 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.91 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.097 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 490 | | 0.91 | 0.35 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 67 | | 0.91 | 0.73 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 9.2 | U | 23 | 9.2 | 3.8 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2400 | EM-03 | 0.91 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 180 | | 0.91 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 1.4 | M-03 | 0.91 | 0.35 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 120 | M-03 | 0.91 | 0.36 | 0.094 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 2.2 | QM-03 | 0.91 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 40000 | BEM-03 | 0.91 | 0.67 | 0.23 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 190 | M-03 | 0.91 | 0.73 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 81 | | 0.91 | 0.68 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 65 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.6 | 1.8 | 0.54 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.91 | 0.36 | 0.18 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.73 | U | 0.91 | 0.73 | 0.23 | ng/L | 1 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-027
Description: CMT-VRTB-01_2_07182024
Matrix: Aqueous
Date Sampled: 07/18/2024 1005
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 40-200 | M-03 | 83 | 40-200 | H | 86 | 40-200 |
| 13C2-6:2FTS | | 97 | 40-200 | | 86 | 40-200 | H | 84 | 40-200 |
| 13C2-8:2FTS | | 92 | 40-300 | M-03 | 77 | 40-300 | H | 81 | 40-300 |
| 13C2-PFDoA | | 69 | 10-130 | | 63 | 10-130 | H | 70 | 10-130 |
| 13C2-PFTeDA | | 67 | 10-130 | | 60 | 10-130 | H | 68 | 10-130 |
| 13C3-HFPO-DA | | 79 | 40-130 | | 83 | 40-130 | H | 77 | 40-130 |
| 13C3-PFBS | | 96 | 40-135 | | 76 | 40-135 | H | 90 | 40-135 |
| 13C3-PFHxS | | 71 | 40-130 | | 80 | 40-130 | H | 89 | 40-130 |
| 13C4-PFBA | | 78 | 5.0-130 | | 79 | 5.0-130 | H | 81 | 5.0-130 |
| 13C4-PFHpA | | 77 | 40-130 | | 76 | 40-130 | H | 84 | 40-130 |
| 13C5-PFHxA | | 78 | 40-130 | | 81 | 40-130 | H | 79 | 40-130 |
| 13C5-PFPeA | | 79 | 40-130 | | 83 | 40-130 | H | 84 | 40-130 |
| 13C6-PFDA | | 74 | 40-130 | | 74 | 40-130 | H | 79 | 40-130 |
| 13C7-PFUnA | | 66 | 30-130 | M-03 | 65 | 30-130 | H | 76 | 30-130 |
| 13C8-PFOA | | 75 | 40-130 | | 80 | 40-130 | H | 81 | 40-130 |
| 13C8-PFOS | M-03 | 71 | 40-130 | | 71 | 40-130 | H | 78 | 40-130 |
| 13C8-PFOSA | N | 189 | 40-130 | | 81 | 40-130 | H | 79 | 40-130 |
| 13C9-PFNA | | 68 | 40-130 | | 73 | 40-130 | H | 80 | 40-130 |
| D3-NMeFOSA | N | 152 | 10-130 | | 72 | 10-130 | H | 58 | 10-130 |
| D3-NMeFOSAA | | 169 | 40-170 | | 86 | 40-170 | H | 77 | 40-170 |
| D5-NEtFOSA | N | 144 | 10-130 | | 68 | 10-130 | H | 58 | 10-130 |
| D5-NEtFOSAA | | 106 | 25-135 | | 64 | 25-135 | H | 73 | 25-135 |
| D7-NMeFOSE | N | 157 | 10-130 | | 77 | 10-130 | H | 71 | 10-130 |
| D9-NEtFOSE | N | 147 | 10-130 | | 71 | 10-130 | H | 71 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-027
Description: CMT-VRTB-01_2_07182024 | Matrix: Aqueous
Date Sampled: 07/18/2024 1005 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/15/2024 1446 | BWS | 08/13/2024 1925 | 16118 |
| 2 | 1633 | 1633 | 10 | 08/17/2024 0933 | BWS | 08/13/2024 1925 | 16118 |
| 3 | 1633 | 1633 | 1 | 08/24/2024 0918 | BWS | 08/20/2024 1708 | 16518 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 21 | U | 36 | 21 | 8.0 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 20 | U | 36 | 20 | 6.1 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 21 | U | 36 | 21 | 6.1 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 54 | M-03 | 36 | 14 | 5.6 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 14 | U | 36 | 14 | 3.6 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 90 | | 46 | 42 | 18 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 92 | U | 230 | 92 | 39 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 22 | U | 36 | 22 | 9.1 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 3.6 | U | 9.1 | 3.6 | 1.2 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 7.3 | U | 9.1 | 7.3 | 2.7 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 18 | U | 91 | 18 | 5.6 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 7.3 | U | 9.1 | 7.3 | 2.0 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 7.3 | U | 9.1 | 7.3 | 2.7 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 18 | U | 91 | 18 | 5.8 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 12 | U | 18 | 12 | 5.3 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 9.9 | U | 18 | 9.9 | 3.3 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 5.8 | U | 18 | 5.8 | 1.7 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 12 | U | 18 | 12 | 3.5 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 31 | | 9.1 | 3.2 | 0.86 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 28 | JM-03 | 36 | 14 | 4.7 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 3.5 | U | 9.1 | 3.5 | 1.5 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 3.6 | U | 9.1 | 3.6 | 1.2 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 3.5 | U | 9.1 | 3.5 | 1.4 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 3.6 | U | 9.1 | 3.6 | 0.97 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 230 | | 9.1 | 3.5 | 1.7 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 69 | | 9.1 | 7.3 | 1.9 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 92 | U | 230 | 92 | 38 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 2200 | M-03 | 9.1 | 6.6 | 1.7 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 180 | | 9.1 | 3.6 | 1.3 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 3.5 | U | 9.1 | 3.5 | 1.3 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 100 | M-03 | 9.1 | 3.6 | 0.94 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 3.6 | U | 9.1 | 3.6 | 1.8 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 40000 | BEM-03 | 9.1 | 6.7 | 2.3 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 220 | M-03 | 9.1 | 7.3 | 1.9 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 68 | | 9.1 | 6.8 | 2.3 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 64 | | 18 | 3.6 | 1.7 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 18 | U | 46 | 18 | 5.4 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 7.3 | U | 9.1 | 7.3 | 2.4 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 3.6 | U | 9.1 | 3.6 | 1.8 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 7.3 | U | 9.1 | 7.3 | 2.3 | ng/L | 2 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-027
Description: CMT-VRTB-01_2_07182024
Matrix: Aqueous
Date Sampled: 07/18/2024 1005
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 40-200 | M-03 | 83 | 40-200 | H | 86 | 40-200 |
| 13C2-6:2FTS | | 97 | 40-200 | | 86 | 40-200 | H | 84 | 40-200 |
| 13C2-8:2FTS | | 92 | 40-300 | M-03 | 77 | 40-300 | H | 81 | 40-300 |
| 13C2-PFDoA | | 69 | 10-130 | | 63 | 10-130 | H | 70 | 10-130 |
| 13C2-PFTeDA | | 67 | 10-130 | | 60 | 10-130 | H | 68 | 10-130 |
| 13C3-HFPO-DA | | 79 | 40-130 | | 83 | 40-130 | H | 77 | 40-130 |
| 13C3-PFBS | | 96 | 40-135 | | 76 | 40-135 | H | 90 | 40-135 |
| 13C3-PFHxS | | 71 | 40-130 | | 80 | 40-130 | H | 89 | 40-130 |
| 13C4-PFBA | | 78 | 5.0-130 | | 79 | 5.0-130 | H | 81 | 5.0-130 |
| 13C4-PFHpA | | 77 | 40-130 | | 76 | 40-130 | H | 84 | 40-130 |
| 13C5-PFHxA | | 78 | 40-130 | | 81 | 40-130 | H | 79 | 40-130 |
| 13C5-PFPeA | | 79 | 40-130 | | 83 | 40-130 | H | 84 | 40-130 |
| 13C6-PFDA | | 74 | 40-130 | | 74 | 40-130 | H | 79 | 40-130 |
| 13C7-PFUnA | | 66 | 30-130 | M-03 | 65 | 30-130 | H | 76 | 30-130 |
| 13C8-PFOA | | 75 | 40-130 | | 80 | 40-130 | H | 81 | 40-130 |
| 13C8-PFOS | M-03 | 71 | 40-130 | | 71 | 40-130 | H | 78 | 40-130 |
| 13C8-PFOSA | N | 189 | 40-130 | | 81 | 40-130 | H | 79 | 40-130 |
| 13C9-PFNA | | 68 | 40-130 | | 73 | 40-130 | H | 80 | 40-130 |
| D3-NMeFOSA | N | 152 | 10-130 | | 72 | 10-130 | H | 58 | 10-130 |
| D3-NMeFOSAA | | 169 | 40-170 | | 86 | 40-170 | H | 77 | 40-170 |
| D5-NEtFOSA | N | 144 | 10-130 | | 68 | 10-130 | H | 58 | 10-130 |
| D5-NEtFOSAA | | 106 | 25-135 | | 64 | 25-135 | H | 73 | 25-135 |
| D7-NMeFOSE | N | 157 | 10-130 | | 77 | 10-130 | H | 71 | 10-130 |
| D9-NEtFOSE | N | 147 | 10-130 | | 71 | 10-130 | H | 71 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-027
Description: CMT-VRTB-01_2_07182024 | Matrix: Aqueous
Date Sampled: 07/18/2024 1005 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/15/2024 1446 | BWS | 08/13/2024 1925 | 16118 |
| 2 | 1633 | 1633 | 10 | 08/17/2024 0933 | BWS | 08/13/2024 1925 | 16118 |
| 3 | 1633 | 1633 | 1 | 08/24/2024 0918 | BWS | 08/20/2024 1708 | 16518 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 230 | UH | 400 | 230 | 87 | ng/L | 3 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 220 | UH | 400 | 220 | 67 | ng/L | 3 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 230 | UH | 400 | 230 | 66 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 68 | HJM-03 | 400 | 150 | 61 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 150 | UH | 400 | 150 | 40 | ng/L | 3 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 460 | UH | 500 | 460 | 200 | ng/L | 3 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 1000 | UH | 2500 | 1000 | 430 | ng/L | 3 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 240 | UH | 400 | 240 | 99 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 40 | UH | 100 | 40 | 13 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 80 | UHL | 100 | 80 | 29 | ng/L | 3 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 200 | UH | 1000 | 200 | 61 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 80 | UH | 100 | 80 | 22 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 80 | UH | 100 | 80 | 29 | ng/L | 3 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 200 | UH | 1000 | 200 | 63 | ng/L | 3 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 130 | UH | 200 | 130 | 58 | ng/L | 3 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 110 | UH | 200 | 110 | 36 | ng/L | 3 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 64 | UH | 200 | 64 | 18 | ng/L | 3 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 130 | UH | 200 | 130 | 39 | ng/L | 3 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 33 | HJM-03 | 100 | 35 | 9.4 | ng/L | 3 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 160 | UHM-03 | 400 | 160 | 51 | ng/L | 3 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 39 | UH | 100 | 39 | 16 | ng/L | 3 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 40 | UH | 100 | 40 | 14 | ng/L | 3 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 39 | UH | 100 | 39 | 15 | ng/L | 3 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 40 | UH | 100 | 40 | 11 | ng/L | 3 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 190 | H | 100 | 38 | 19 | ng/L | 3 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 75 | HJM-03 | 100 | 80 | 21 | ng/L | 3 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 1000 | UH | 2500 | 1000 | 420 | ng/L | 3 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 1800 | HM-03 | 100 | 73 | 18 | ng/L | 3 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 190 | HM-03 | 100 | 40 | 14 | ng/L | 3 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 38 | UH | 100 | 38 | 15 | ng/L | 3 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 99 | HJM-03 | 100 | 40 | 10 | ng/L | 3 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 40 | UH | 100 | 40 | 20 | ng/L | 3 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 37000 | HM-03 | 100 | 74 | 25 | ng/L | 3 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 200 | HM-03 | 100 | 80 | 21 | ng/L | 3 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 71 | HJM-03 | 100 | 75 | 26 | ng/L | 3 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 40 | UH | 200 | 40 | 18 | ng/L | 3 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 200 | UH | 500 | 200 | 60 | ng/L | 3 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 80 | UH | 100 | 80 | 27 | ng/L | 3 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 40 | UH | 100 | 40 | 19 | ng/L | 3 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 80 | UH | 100 | 80 | 25 | ng/L | 3 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-027
Description: CMT-VRTB-01_2_07182024
Matrix: Aqueous
Date Sampled: 07/18/2024 1005
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits | Q | Run 3 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 98 | 40-200 | M-03 | 83 | 40-200 | H | 86 | 40-200 |
| 13C2-6:2FTS | | 97 | 40-200 | | 86 | 40-200 | H | 84 | 40-200 |
| 13C2-8:2FTS | | 92 | 40-300 | M-03 | 77 | 40-300 | H | 81 | 40-300 |
| 13C2-PFDoA | | 69 | 10-130 | | 63 | 10-130 | H | 70 | 10-130 |
| 13C2-PFTeDA | | 67 | 10-130 | | 60 | 10-130 | H | 68 | 10-130 |
| 13C3-HFPO-DA | | 79 | 40-130 | | 83 | 40-130 | H | 77 | 40-130 |
| 13C3-PFBS | | 96 | 40-135 | | 76 | 40-135 | H | 90 | 40-135 |
| 13C3-PFHxS | | 71 | 40-130 | | 80 | 40-130 | H | 89 | 40-130 |
| 13C4-PFBA | | 78 | 5.0-130 | | 79 | 5.0-130 | H | 81 | 5.0-130 |
| 13C4-PFHpA | | 77 | 40-130 | | 76 | 40-130 | H | 84 | 40-130 |
| 13C5-PFHxA | | 78 | 40-130 | | 81 | 40-130 | H | 79 | 40-130 |
| 13C5-PFPeA | | 79 | 40-130 | | 83 | 40-130 | H | 84 | 40-130 |
| 13C6-PFDA | | 74 | 40-130 | | 74 | 40-130 | H | 79 | 40-130 |
| 13C7-PFUnA | | 66 | 30-130 | M-03 | 65 | 30-130 | H | 76 | 30-130 |
| 13C8-PFOA | | 75 | 40-130 | | 80 | 40-130 | H | 81 | 40-130 |
| 13C8-PFOS | M-03 | 71 | 40-130 | | 71 | 40-130 | H | 78 | 40-130 |
| 13C8-PFOSA | N | 189 | 40-130 | | 81 | 40-130 | H | 79 | 40-130 |
| 13C9-PFNA | | 68 | 40-130 | | 73 | 40-130 | H | 80 | 40-130 |
| D3-NMeFOSA | N | 152 | 10-130 | | 72 | 10-130 | H | 58 | 10-130 |
| D3-NMeFOSAA | | 169 | 40-170 | | 86 | 40-170 | H | 77 | 40-170 |
| D5-NEtFOSA | N | 144 | 10-130 | | 68 | 10-130 | H | 58 | 10-130 |
| D5-NEtFOSAA | | 106 | 25-135 | | 64 | 25-135 | H | 73 | 25-135 |
| D7-NMeFOSE | N | 157 | 10-130 | | 77 | 10-130 | H | 71 | 10-130 |
| D9-NEtFOSE | N | 147 | 10-130 | | 71 | 10-130 | H | 71 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-028
Description: CMT-VRTB-01_3_07182024 | Matrix: Aqueous
Date Sampled: 07/18/2024 1040 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/20/2024 0854 | BWS | 08/14/2024 1924 | 16172 |
| 2 | 1633 | 1633 | 1 | 08/24/2024 0632 | BWS | 08/22/2024 1636 | 16603 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.79 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 16 | | 3.6 | 1.4 | 0.55 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 16 | | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.55 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.27 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.57 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 8.0 | M-03 | 0.90 | 0.32 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 16 | | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.096 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 39 | | 0.90 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 30 | | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 380 | | 0.90 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 35 | | 0.90 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.90 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 31 | M-03 | 0.90 | 0.36 | 0.093 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.61 | JM-03 | 0.90 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 5200 | BEM-03 | 0.90 | 0.67 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 49 | M-03 | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 13 | | 0.90 | 0.68 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 27 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.54 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-028
Description: CMT-VRTB-01_3_07182024
Matrix: Aqueous
Date Sampled: 07/18/2024 1040
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 91 | 40-200 | H | 84 | 40-200 |
| 13C2-6:2FTS | | 94 | 40-200 | H | 82 | 40-200 |
| 13C2-8:2FTS | | 82 | 40-300 | H | 78 | 40-300 |
| 13C2-PFDoA | | 71 | 10-130 | H | 69 | 10-130 |
| 13C2-PFTeDA | | 67 | 10-130 | H | 67 | 10-130 |
| 13C3-HFPO-DA | | 84 | 40-130 | H | 82 | 40-130 |
| 13C3-PFBS | | 95 | 40-135 | H | 83 | 40-135 |
| 13C3-PFHxS | | 88 | 40-130 | H | 84 | 40-130 |
| 13C4-PFBA | | 87 | 5.0-130 | H | 88 | 5.0-130 |
| 13C4-PFHpA | | 85 | 40-130 | H | 84 | 40-130 |
| 13C5-PFHxA | | 86 | 40-130 | H | 86 | 40-130 |
| 13C5-PFPeA | | 86 | 40-130 | H | 86 | 40-130 |
| 13C6-PFDA | | 87 | 40-130 | H | 82 | 40-130 |
| 13C7-PFUnA | | 79 | 30-130 | H | 86 | 30-130 |
| 13C8-PFOA | | 81 | 40-130 | H | 92 | 40-130 |
| 13C8-PFOS | | 82 | 40-130 | H | 82 | 40-130 |
| 13C8-PFOSA | | 123 | 40-130 | H | 90 | 40-130 |
| 13C9-PFNA | | 79 | 40-130 | H | 83 | 40-130 |
| D3-NMeFOSA | | 96 | 10-130 | H | 51 | 10-130 |
| D3-NMeFOSAA | | 118 | 40-170 | H | 80 | 40-170 |
| D5-NEtFOSA | | 90 | 10-130 | H | 47 | 10-130 |
| D5-NEtFOSAA | | 79 | 25-135 | H | 79 | 25-135 |
| D7-NMeFOSE | | 100 | 10-130 | H | 73 | 10-130 |
| D9-NEtFOSE | | 91 | 10-130 | H | 71 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-028
Description: CMT-VRTB-01_3_07182024 | Matrix: Aqueous
Date Sampled: 07/18/2024 1040 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/20/2024 0854 | BWS | 08/14/2024 1924 | 16172 |
| 2 | 1633 | 1633 | 1 | 08/24/2024 0632 | BWS | 08/22/2024 1636 | 16603 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 46 | UH | 80 | 46 | 17 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 44 | UH | 80 | 44 | 13 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 46 | UH | 80 | 46 | 13 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 30 | UH | 80 | 30 | 12 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 30 | UH | 80 | 30 | 8.0 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 92 | UH | 100 | 92 | 40 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 200 | UH | 500 | 200 | 86 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 48 | UH | 80 | 48 | 20 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.6 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 16 | UH | 20 | 16 | 5.8 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 40 | UH | 200 | 40 | 12 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 16 | UH | 20 | 16 | 4.3 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 16 | UH | 20 | 16 | 5.9 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 40 | UH | 200 | 40 | 13 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 26 | UH | 40 | 26 | 12 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 22 | UH | 40 | 22 | 7.2 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 13 | UH | 40 | 13 | 3.7 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 26 | UH | 40 | 26 | 7.8 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.2 | HJM-03 | 20 | 7.0 | 1.9 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 19 | HJ | 80 | 32 | 10 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 7.8 | UH | 20 | 7.8 | 3.3 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 8.0 | UH | 20 | 8.0 | 2.7 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 7.8 | UH | 20 | 7.8 | 3.1 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 8.0 | UH | 20 | 8.0 | 2.1 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 30 | HM-03 | 20 | 7.6 | 3.8 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 32 | H | 20 | 16 | 4.3 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 200 | UH | 500 | 200 | 84 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 410 | H | 20 | 15 | 3.7 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 39 | HM-03 | 20 | 8.0 | 2.8 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 7.6 | UH | 20 | 7.6 | 2.9 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 35 | HLM-03 | 20 | 8.0 | 2.1 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 8.0 | UH | 20 | 8.0 | 4.0 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 5100 | HM-03 | 20 | 15 | 4.9 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 61 | HM-03 | 20 | 16 | 4.2 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 12 | HJ | 20 | 15 | 5.1 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 31 | HJM-03 | 40 | 8.0 | 3.7 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 40 | UH | 100 | 40 | 12 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 16 | UH | 20 | 16 | 5.4 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 8.0 | UH | 20 | 8.0 | 3.9 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 16 | UH | 20 | 16 | 5.0 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-028
Description: CMT-VRTB-01_3_07182024
Matrix: Aqueous
Date Sampled: 07/18/2024 1040
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 91 | 40-200 | H | 84 | 40-200 |
| 13C2-6:2FTS | | 94 | 40-200 | H | 82 | 40-200 |
| 13C2-8:2FTS | | 82 | 40-300 | H | 78 | 40-300 |
| 13C2-PFDoA | | 71 | 10-130 | H | 69 | 10-130 |
| 13C2-PFTeDA | | 67 | 10-130 | H | 67 | 10-130 |
| 13C3-HFPO-DA | | 84 | 40-130 | H | 82 | 40-130 |
| 13C3-PFBS | | 95 | 40-135 | H | 83 | 40-135 |
| 13C3-PFHxS | | 88 | 40-130 | H | 84 | 40-130 |
| 13C4-PFBA | | 87 | 5.0-130 | H | 88 | 5.0-130 |
| 13C4-PFHpA | | 85 | 40-130 | H | 84 | 40-130 |
| 13C5-PFHxA | | 86 | 40-130 | H | 86 | 40-130 |
| 13C5-PFPeA | | 86 | 40-130 | H | 86 | 40-130 |
| 13C6-PFDA | | 87 | 40-130 | H | 82 | 40-130 |
| 13C7-PFUnA | | 79 | 30-130 | H | 86 | 30-130 |
| 13C8-PFOA | | 81 | 40-130 | H | 92 | 40-130 |
| 13C8-PFOS | | 82 | 40-130 | H | 82 | 40-130 |
| 13C8-PFOSA | | 123 | 40-130 | H | 90 | 40-130 |
| 13C9-PFNA | | 79 | 40-130 | H | 83 | 40-130 |
| D3-NMeFOSA | | 96 | 10-130 | H | 51 | 10-130 |
| D3-NMeFOSAA | | 118 | 40-170 | H | 80 | 40-170 |
| D5-NEtFOSA | | 90 | 10-130 | H | 47 | 10-130 |
| D5-NEtFOSAA | | 79 | 25-135 | H | 79 | 25-135 |
| D7-NMeFOSE | | 100 | 10-130 | H | 73 | 10-130 |
| D9-NEtFOSE | | 91 | 10-130 | H | 71 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-029
Description: CMT-VRTB-01_4_07182024 | Matrix: Aqueous
Date Sampled: 07/18/2024 1120 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/20/2024 0940 | BWS | 08/14/2024 1924 | 16172 |
| 2 | 1633 | 1633 | 5 | 08/21/2024 0913 | BWS | 08/14/2024 1924 | 16172 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 0.87 | JM-03 | 3.6 | 1.4 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 8.7 | | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.51 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.16 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 7.4 | | 0.89 | 0.31 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 10 | | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 18 | | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 15 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 220 | M-03 | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 19 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 13 | M-03 | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | UM-03 | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 1600 | BM-03 | 4.5 | 3.3 | 1.1 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 28 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 11 | | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 15 | | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | U | 4.5 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-029
Description: CMT-VRTB-01_4_07182024
Matrix: Aqueous
Date Sampled: 07/18/2024 1120
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 91 | 40-200 | M-03 | 85 | 40-200 |
| 13C2-6:2FTS | | 93 | 40-200 | | 97 | 40-200 |
| 13C2-8:2FTS | | 89 | 40-300 | | 82 | 40-300 |
| 13C2-PFDoA | | 77 | 10-130 | M-03 | 71 | 10-130 |
| 13C2-PFTeDA | | 70 | 10-130 | | 66 | 10-130 |
| 13C3-HFPO-DA | | 91 | 40-130 | | 94 | 40-130 |
| 13C3-PFBS | | 94 | 40-135 | | 84 | 40-135 |
| 13C3-PFHxS | | 93 | 40-130 | | 91 | 40-130 |
| 13C4-PFBA | | 90 | 5.0-130 | | 90 | 5.0-130 |
| 13C4-PFHpA | | 94 | 40-130 | | 87 | 40-130 |
| 13C5-PFHxA | | 89 | 40-130 | | 93 | 40-130 |
| 13C5-PFPeA | | 92 | 40-130 | | 95 | 40-130 |
| 13C6-PFDA | | 88 | 40-130 | M-03 | 83 | 40-130 |
| 13C7-PFUnA | | 81 | 30-130 | | 79 | 30-130 |
| 13C8-PFOA | | 92 | 40-130 | | 81 | 40-130 |
| 13C8-PFOS | | 90 | 40-130 | M-03 | 81 | 40-130 |
| 13C8-PFOSA | | 99 | 40-130 | | 82 | 40-130 |
| 13C9-PFNA | | 91 | 40-130 | | 75 | 40-130 |
| D3-NMeFOSA | | 76 | 10-130 | M-03 | 67 | 10-130 |
| D3-NMeFOSAA | | 94 | 40-170 | | 72 | 40-170 |
| D5-NEtFOSA | | 76 | 10-130 | | 63 | 10-130 |
| D5-NEtFOSAA | | 73 | 25-135 | | 64 | 25-135 |
| D7-NMeFOSE | | 85 | 10-130 | | 69 | 10-130 |
| D9-NEtFOSE | | 79 | 10-130 | | 64 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-030
Description: DUP-02_07172024 | Matrix: Aqueous
Date Sampled: 07/17/2024 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/17/2024 1438 | BWS | 08/12/2024 1621 | 16001 |
| 2 | 1633 | 1633 | 1 | 08/23/2024 0621 | ARC2 | 08/21/2024 1616 | 16574 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.78 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.59 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.6 | JM-03 | 3.6 | 1.4 | 0.54 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.35 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.1 | U | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UQ | 8.9 | 1.8 | 0.54 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 8.9 | 1.8 | 0.56 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.2 | | 0.89 | 0.31 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 6.6 | | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.89 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.095 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 9.2 | M-03 | 0.89 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 6.8 | | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.7 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 120 | M-03 | 0.89 | 0.65 | 0.16 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 11 | | 0.89 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.89 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 2.8 | M-03 | 0.89 | 0.36 | 0.092 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 460 | BM-03 | 0.89 | 0.66 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 17 | M-03 | 0.89 | 0.71 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 9.5 | M-03 | 0.89 | 0.67 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 8.8 | M-03 | 1.8 | 0.36 | 0.16 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | UL | 4.5 | 1.8 | 0.53 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.89 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | U | 0.89 | 0.71 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-030
Description: DUP-02_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 80 | 40-200 | H | 80 | 40-200 |
| 13C2-6:2FTS | | 85 | 40-200 | H | 76 | 40-200 |
| 13C2-8:2FTS | | 71 | 40-300 | H | 70 | 40-300 |
| 13C2-PFDoA | | 59 | 10-130 | H | 62 | 10-130 |
| 13C2-PFTeDA | M-03 | 40 | 10-130 | H | 32 | 10-130 |
| 13C3-HFPO-DA | | 80 | 40-130 | H | 87 | 40-130 |
| 13C3-PFBS | | 82 | 40-135 | H | 84 | 40-135 |
| 13C3-PFHxS | | 81 | 40-130 | H | 81 | 40-130 |
| 13C4-PFBA | | 80 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 80 | 40-130 | H | 89 | 40-130 |
| 13C5-PFHxA | | 79 | 40-130 | H | 85 | 40-130 |
| 13C5-PFPeA | | 80 | 40-130 | H | 86 | 40-130 |
| 13C6-PFDA | | 78 | 40-130 | H | 80 | 40-130 |
| 13C7-PFUnA | | 75 | 30-130 | H | 75 | 30-130 |
| 13C8-PFOA | | 75 | 40-130 | H | 85 | 40-130 |
| 13C8-PFOS | | 69 | 40-130 | H | 79 | 40-130 |
| 13C8-PFOSA | | 62 | 40-130 | H | 79 | 40-130 |
| 13C9-PFNA | | 73 | 40-130 | H | 79 | 40-130 |
| D3-NMeFOSA | | 44 | 10-130 | H | 48 | 10-130 |
| D3-NMeFOSAA | | 66 | 40-170 | H | 89 | 40-170 |
| D5-NEtFOSA | | 41 | 10-130 | H | 42 | 10-130 |
| D5-NEtFOSAA | M-03 | 53 | 25-135 | H | 78 | 25-135 |
| D7-NMeFOSE | | 17 | 10-130 | H | 56 | 10-130 |
| D9-NEtFOSE | N | 8.0 | 10-130 | H | 44 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-030
Description: DUP-02_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/17/2024 1438 | BWS | 08/12/2024 1621 | 16001 |
| 2 | 1633 | 1633 | 1 | 08/23/2024 0621 | ARC2 | 08/21/2024 1616 | 16574 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | UH | 3.6 | 2.1 | 0.78 | ng/L | 2 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | UH | 3.6 | 2.0 | 0.60 | ng/L | 2 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | UH | 3.6 | 2.1 | 0.59 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 2.1 | HJM-03 | 3.6 | 1.4 | 0.54 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | UH | 3.6 | 1.4 | 0.35 | ng/L | 2 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.1 | UH | 4.5 | 4.1 | 1.8 | ng/L | 2 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | UH | 22 | 8.8 | 3.8 | ng/L | 2 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | UH | 3.6 | 2.2 | 0.89 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.11 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.26 | ng/L | 2 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | UH | 8.9 | 1.8 | 0.54 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.19 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.26 | ng/L | 2 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | UH | 8.9 | 1.8 | 0.56 | ng/L | 2 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | UH | 1.8 | 1.2 | 0.51 | ng/L | 2 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | UH | 1.8 | 0.99 | 0.32 | ng/L | 2 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | UH | 1.8 | 0.58 | 0.16 | ng/L | 2 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | UH | 1.8 | 1.2 | 0.35 | ng/L | 2 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 5.3 | HM-03 | 0.89 | 0.31 | 0.084 | ng/L | 2 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 7.2 | HM-03 | 3.6 | 1.4 | 0.45 | ng/L | 2 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | UH | 0.89 | 0.35 | 0.15 | ng/L | 2 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.12 | ng/L | 2 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | UH | 0.89 | 0.35 | 0.14 | ng/L | 2 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.095 | ng/L | 2 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 9.1 | H | 0.89 | 0.34 | 0.17 | ng/L | 2 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 6.9 | H | 0.89 | 0.71 | 0.19 | ng/L | 2 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | UH | 22 | 8.8 | 3.7 | ng/L | 2 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 120 | HM-03 | 0.89 | 0.65 | 0.16 | ng/L | 2 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 12 | H | 0.89 | 0.36 | 0.13 | ng/L | 2 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | UH | 0.89 | 0.34 | 0.13 | ng/L | 2 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 2.6 | HM-03 | 0.89 | 0.36 | 0.092 | ng/L | 2 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | UHM-03 | 0.89 | 0.36 | 0.18 | ng/L | 2 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 470 | HM-03 | 0.89 | 0.66 | 0.22 | ng/L | 2 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 18 | HM-03 | 0.89 | 0.71 | 0.19 | ng/L | 2 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 8.5 | H | 0.89 | 0.67 | 0.23 | ng/L | 2 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 8.7 | H | 1.8 | 0.36 | 0.16 | ng/L | 2 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | UH | 4.5 | 1.8 | 0.53 | ng/L | 2 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.24 | ng/L | 2 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | UH | 0.89 | 0.36 | 0.17 | ng/L | 2 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.71 | UH | 0.89 | 0.71 | 0.22 | ng/L | 2 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-030
Description: DUP-02_07172024
Matrix: Aqueous
Date Sampled: 07/17/2024
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits | Q | Run 2 % Recovery | Acceptance Limits |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS | | 80 | 40-200 | H | 80 | 40-200 |
| 13C2-6:2FTS | | 85 | 40-200 | H | 76 | 40-200 |
| 13C2-8:2FTS | | 71 | 40-300 | H | 70 | 40-300 |
| 13C2-PFDoA | | 59 | 10-130 | H | 62 | 10-130 |
| 13C2-PFTeDA | M-03 | 40 | 10-130 | H | 32 | 10-130 |
| 13C3-HFPO-DA | | 80 | 40-130 | H | 87 | 40-130 |
| 13C3-PFBS | | 82 | 40-135 | H | 84 | 40-135 |
| 13C3-PFHxS | | 81 | 40-130 | H | 81 | 40-130 |
| 13C4-PFBA | | 80 | 5.0-130 | H | 86 | 5.0-130 |
| 13C4-PFHpA | | 80 | 40-130 | H | 89 | 40-130 |
| 13C5-PFHxA | | 79 | 40-130 | H | 85 | 40-130 |
| 13C5-PFPeA | | 80 | 40-130 | H | 86 | 40-130 |
| 13C6-PFDA | | 78 | 40-130 | H | 80 | 40-130 |
| 13C7-PFUnA | | 75 | 30-130 | H | 75 | 30-130 |
| 13C8-PFOA | | 75 | 40-130 | H | 85 | 40-130 |
| 13C8-PFOS | | 69 | 40-130 | H | 79 | 40-130 |
| 13C8-PFOSA | | 62 | 40-130 | H | 79 | 40-130 |
| 13C9-PFNA | | 73 | 40-130 | H | 79 | 40-130 |
| D3-NMeFOSA | | 44 | 10-130 | H | 48 | 10-130 |
| D3-NMeFOSAA | | 66 | 40-170 | H | 89 | 40-170 |
| D5-NEtFOSA | | 41 | 10-130 | H | 42 | 10-130 |
| D5-NEtFOSAA | M-03 | 53 | 25-135 | H | 78 | 25-135 |
| D7-NMeFOSE | | 17 | 10-130 | H | 56 | 10-130 |
| D9-NEtFOSE | N | 8.0 | 10-130 | H | 44 | 10-130 |

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOD
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: ZG19017-031
Description: CMT-VRTB-01_5_07182024 | Matrix: Aqueous
Date Sampled: 07/18/2024 1155 | Project Name: ESTCP Vertebrae
Date Received: 07/19/2024 | Project Number: 30027244.00004

| Run | Prep Method | Analytical Method | Dilution | Analysis Date | Analyst | Prep Date | Batch |
|---|---|---|---|---|---|---|---|
| 1 | 1633 | 1633 | 1 | 08/17/2024 1447 | BWS | 08/12/2024 1621 | 16001 |

| Parameter | CAS Number | Analytical Method | Result | Q | LOQ | LOD | DL | Units | Run |
|---|---|---|---|---|---|---|---|---|---|
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3...) | 763051-92-9 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.79 | ng/L | 1 |
| 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS) | 756426-58-1 | 1633 | 2.0 | U | 3.6 | 2.0 | 0.60 | ng/L | 1 |
| 4,8-Dioxa-3H-perfluorononanoic acid (ADONA) | 919005-14-4 | 1633 | 2.1 | U | 3.6 | 2.1 | 0.60 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS) | 39108-34-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.55 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS) | 757124-72-4 | 1633 | 1.4 | U | 3.6 | 1.4 | 0.36 | ng/L | 1 |
| 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS) | 27619-97-2 | 1633 | 4.1 | U | 4.5 | 4.1 | 1.8 | ng/L | 1 |
| 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA) | 914637-49-3 | 1633 | 8.8 | U | 22 | 8.8 | 3.9 | ng/L | 1 |
| Hexafluoropropylene oxide dimer acid (HFPO-DA) | 13252-13-6 | 1633 | 2.2 | U | 3.6 | 2.2 | 0.89 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamide (NEtFOSA) | 4151-50-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 2991-50-6 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE) | 1691-99-2 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.55 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamide (NMeFOSA) | 31506-32-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 2355-31-9 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.26 | ng/L | 1 |
| N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE) | 24448-09-7 | 1633 | 1.8 | U | 9.0 | 1.8 | 0.57 | ng/L | 1 |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | 151772-58-6 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.52 | ng/L | 1 |
| Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) | 113507-82-7 | 1633 | 0.99 | U | 1.8 | 0.99 | 0.32 | ng/L | 1 |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | 377-73-1 | 1633 | 0.58 | U | 1.8 | 0.58 | 0.17 | ng/L | 1 |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | 863090-89-5 | 1633 | 1.2 | U | 1.8 | 1.2 | 0.35 | ng/L | 1 |
| Perfluorobutanesulfonic acid (PFBS) | 375-73-5 | 1633 | 9.2 | M-03 | 0.90 | 0.32 | 0.084 | ng/L | 1 |
| Perfluorobutanoic acid (PFBA) | 375-22-4 | 1633 | 10 | | 3.6 | 1.4 | 0.46 | ng/L | 1 |
| Perfluorodecanesulfonic acid (PFDS) | 335-77-3 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.15 | ng/L | 1 |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.12 | ng/L | 1 |
| Perfluorododecanesulfonic acid (PFDoS) | 79780-39-5 | 1633 | 0.35 | U | 0.90 | 0.35 | 0.14 | ng/L | 1 |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.096 | ng/L | 1 |
| Perfluoroheptanesulfonic acid (PFHpS) | 375-92-8 | 1633 | 8.0 | | 0.90 | 0.34 | 0.17 | ng/L | 1 |
| Perfluoroheptanoic acid (PFHpA) | 375-85-9 | 1633 | 11 | | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| 3-Perfluoroheptyl propanoic acid (7:3FTCA) | 812-70-4 | 1633 | 8.8 | U | 22 | 8.8 | 3.8 | ng/L | 1 |
| Perfluorohexanesulfonic acid (PFHxS) | 355-46-4 | 1633 | 160 | M-03 | 0.90 | 0.66 | 0.17 | ng/L | 1 |
| Perfluorohexanoic acid (PFHxA) | 307-24-4 | 1633 | 17 | | 0.90 | 0.36 | 0.13 | ng/L | 1 |
| Perfluorononanesulfonic acid (PFNS) | 68259-12-1 | 1633 | 0.34 | U | 0.90 | 0.34 | 0.13 | ng/L | 1 |
| Perfluorononanoic acid (PFNA) | 375-95-1 | 1633 | 2.2 | M-03 | 0.90 | 0.36 | 0.093 | ng/L | 1 |
| Perfluorooctanesulfonamide (PFOSA) | 754-91-6 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.18 | ng/L | 1 |
| Perfluorooctanesulfonic acid (PFOS) | 1763-23-1 | 1633 | 310 | BM-03 | 0.90 | 0.67 | 0.22 | ng/L | 1 |
| Perfluorooctanoic acid (PFOA) | 335-67-1 | 1633 | 20 | M-03 | 0.90 | 0.72 | 0.19 | ng/L | 1 |
| Perfluoropentanesulfonic acid (PFPeS) | 2706-91-4 | 1633 | 12 | | 0.90 | 0.68 | 0.23 | ng/L | 1 |
| Perfluoropentanoic acid (PFPeA) | 2706-90-3 | 1633 | 13 | | 1.8 | 0.36 | 0.17 | ng/L | 1 |
| 3-Perfluoropropyl propanoic acid (3:3FTCA) | 356-02-5 | 1633 | 1.8 | UL | 4.5 | 1.8 | 0.54 | ng/L | 1 |
| Perfluorotetradecanoic acid (PFTeDA) | 376-06-7 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.24 | ng/L | 1 |
| Perfluorotridecanoic acid (PFTrDA) | 72629-94-8 | 1633 | 0.36 | U | 0.90 | 0.36 | 0.17 | ng/L | 1 |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | 1633 | 0.72 | U | 0.90 | 0.72 | 0.22 | ng/L | 1 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: ZG19017-031
Description: CMT-VRTB-01_5_07182024
Matrix: Aqueous
Date Sampled: 07/18/2024 1155
Project Name: ESTCP Vertebrae
Date Received: 07/19/2024
Project Number: 30027244.00004

| Surrogate | Q | Run 1 % Recovery | Acceptance Limits |
|---|---|---|---|
| 13C2-4:2FTS | | 75 | 40-200 |
| 13C2-6:2FTS | M-03 | 79 | 40-200 |
| 13C2-8:2FTS | | 74 | 40-300 |
| 13C2-PFDoA | | 67 | 10-130 |
| 13C2-PFTeDA | | 60 | 10-130 |
| 13C3-HFPO-DA | | 76 | 40-130 |
| 13C3-PFBS | | 83 | 40-135 |
| 13C3-PFHxS | | 78 | 40-130 |
| 13C4-PFBA | | 77 | 5.0-130 |
| 13C4-PFHpA | | 75 | 40-130 |
| 13C5-PFHxA | | 78 | 40-130 |
| 13C5-PFPeA | | 76 | 40-130 |
| 13C6-PFDA | | 67 | 40-130 |
| 13C7-PFUnA | | 72 | 30-130 |
| 13C8-PFOA | | 67 | 40-130 |
| 13C8-PFOS | | 71 | 40-130 |
| 13C8-PFOSA | | 62 | 40-130 |
| 13C9-PFNA | | 72 | 40-130 |
| D3-NMeFOSA | | 45 | 10-130 |
| D3-NMeFOSAA | | 68 | 40-170 |
| D5-NEtFOSA | M-03 | 49 | 10-130 |
| D5-NEtFOSAA | | 55 | 25-135 |
| D7-NMeFOSE | | 59 | 10-130 |
| D9-NEtFOSE | | 57 | 10-130 |

LOQ = Limit of Quantitation
U = Not detected at or above the LOD
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# QC Summary

# PFAS by LC/MS/MS - MB

Sample ID: ZQ15907-001
Batch: 15907
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 08/19/2024 2054 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 08/19/2024 2054 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 08/19/2024 2054 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 08/19/2024 2054 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 08/19/2024 2054 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 08/19/2024 2054 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 08/19/2024 2054 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 08/19/2024 2054 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 08/19/2024 2054 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/19/2024 2054 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 08/19/2024 2054 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 08/19/2024 2054 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/19/2024 2054 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 08/19/2024 2054 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 08/19/2024 2054 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 08/19/2024 2054 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 08/19/2024 2054 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 08/19/2024 2054 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 08/19/2024 2054 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 08/19/2024 2054 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 08/19/2024 2054 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/19/2024 2054 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 08/19/2024 2054 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 08/19/2024 2054 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 08/19/2024 2054 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/19/2024 2054 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 08/19/2024 2054 |
| PFHxS | 0.73 | UM-03 | 1 | 1.0 | 0.73 | 0.18 | ng/L | 08/19/2024 2054 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/19/2024 2054 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 08/19/2024 2054 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 08/19/2024 2054 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 08/19/2024 2054 |
| PFOS | 0.74 | UM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 08/19/2024 2054 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/19/2024 2054 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 08/19/2024 2054 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 08/19/2024 2054 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 08/19/2024 2054 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 08/19/2024 2054 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 08/19/2024 2054 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 08/19/2024 2054 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 92 | 40-200 |
| 13C2-6:2FTS | | 98 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ15907-001
Batch: 15907
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 87 | 40-300 |
| 13C2-PFDoA | | 84 | 10-130 |
| 13C2-PFTeDA | | 76 | 10-130 |
| 13C3-HFPO-DA | | 91 | 40-130 |
| 13C3-PFBS | | 98 | 40-135 |
| 13C3-PFHxS | | 100 | 40-130 |
| 13C4-PFBA | | 92 | 5-130 |
| 13C4-PFHpA | | 92 | 40-130 |
| 13C5-PFHxA | | 92 | 40-130 |
| 13C5-PFPeA | | 95 | 40-130 |
| 13C6-PFDA | | 97 | 40-130 |
| 13C7-PFUnA | | 90 | 30-130 |
| 13C8-PFOA | | 85 | 40-130 |
| 13C8-PFOS | | 86 | 40-130 |
| 13C8-PFOSA | | 74 | 40-130 |
| 13C9-PFNA | | 92 | 40-130 |
| D3-NMeFOSA | | 33 | 10-130 |
| D3-NMeFOSAA | | 86 | 40-170 |
| D5-NEtFOSA | | 31 | 10-130 |
| D5-NEtFOSAA | | 75 | 25-135 |
| D7-NMeFOSE | | 52 | 10-130 |
| D9-NEtFOSE | | 54 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ15907-002
Batch: 15907
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 72 | | 1 | 79 | 55-160 | 08/19/2024 2103 |
| 9Cl-PF3ONS | 90 | 82 | | 1 | 92 | 70-155 | 08/19/2024 2103 |
| ADONA | 91 | 83 | | 1 | 92 | 65-145 | 08/19/2024 2103 |
| 8:2FTS | 92 | 80 | | 1 | 87 | 60-150 | 08/19/2024 2103 |
| 4:2FTS | 90 | 81 | | 1 | 90 | 70-145 | 08/19/2024 2103 |
| 6:2FTS | 91 | 86 | | 1 | 94 | 65-155 | 08/19/2024 2103 |
| 5:3FTCA | 600 | 550 | | 1 | 91 | 70-135 | 08/19/2024 2103 |
| HFPO-DA | 96 | 84 | | 1 | 87 | 70-140 | 08/19/2024 2103 |
| NEtFOSA | 24 | 23 | | 1 | 96 | 65-145 | 08/19/2024 2103 |
| NEtFOSAA | 24 | 23 | M-03 | 1 | 94 | 70-145 | 08/19/2024 2103 |
| NEtFOSE | 240 | 220 | | 1 | 92 | 70-135 | 08/19/2024 2103 |
| NMeFOSA | 24 | 23 | | 1 | 97 | 60-150 | 08/19/2024 2103 |
| NMeFOSAA | 24 | 21 | M-03 | 1 | 86 | 50-140 | 08/19/2024 2103 |
| NMeFOSE | 240 | 220 | | 1 | 93 | 70-145 | 08/19/2024 2103 |
| NFDHA | 48 | 44 | | 1 | 91 | 50-150 | 08/19/2024 2103 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 41 | | 1 | 96 | 70-140 | 08/19/2024 2103 |
| PFMPA | 48 | 46 | | 1 | 96 | 55-140 | 08/19/2024 2103 |
| PFMBA | 48 | 44 | | 1 | 91 | 60-150 | 08/19/2024 2103 |
| PFBS | 21 | 18 | | 1 | 86 | 60-145 | 08/19/2024 2103 |
| PFBA | 96 | 85 | | 1 | 89 | 70-140 | 08/19/2024 2103 |
| PFDS | 23 | 19 | | 1 | 81 | 60-145 | 08/19/2024 2103 |
| PFDA | 24 | 21 | | 1 | 86 | 70-140 | 08/19/2024 2103 |
| PFDoS | 23 | 16 | | 1 | 69 | 50-145 | 08/19/2024 2103 |
| PFDoA | 24 | 22 | | 1 | 92 | 70-140 | 08/19/2024 2103 |
| PFHpS | 23 | 21 | | 1 | 91 | 70-150 | 08/19/2024 2103 |
| PFHpA | 24 | 22 | | 1 | 93 | 70-150 | 08/19/2024 2103 |
| 7:3FTCA | 600 | 510 | | 1 | 86 | 50-145 | 08/19/2024 2103 |
| PFHxS | 22 | 17 | | 1 | 78 | 65-145 | 08/19/2024 2103 |
| PFHxA | 24 | 22 | | 1 | 91 | 70-145 | 08/19/2024 2103 |
| PFNS | 23 | 20 | | 1 | 87 | 65-145 | 08/19/2024 2103 |
| PFNA | 24 | 23 | | 1 | 96 | 70-150 | 08/19/2024 2103 |
| PFOSA | 24 | 23 | | 1 | 97 | 70-145 | 08/19/2024 2103 |
| PFOS | 22 | 19 | M-03 | 1 | 85 | 55-150 | 08/19/2024 2103 |
| PFOA | 24 | 20 | | 1 | 85 | 70-150 | 08/19/2024 2103 |
| PFPeS | 23 | 19 | | 1 | 85 | 65-140 | 08/19/2024 2103 |
| PFPeA | 48 | 43 | | 1 | 89 | 65-135 | 08/19/2024 2103 |
| 3:3FTCA | 120 | 110 | | 1 | 90 | 65-130 | 08/19/2024 2103 |
| PFTeDA | 24 | 22 | | 1 | 93 | 60-140 | 08/19/2024 2103 |
| PFTrDA | 24 | 24 | | 1 | 99 | 65-140 | 08/19/2024 2103 |
| PFUnA | 24 | 22 | | 1 | 92 | 70-145 | 08/19/2024 2103 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 83 | 40-200 |
| 13C2-6:2FTS | | 80 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ15907-002
Batch: 15907
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 80 | 40-300 |
| 13C2-PFDoA | | 67 | 10-130 |
| 13C2-PFTeDA | | 60 | 10-130 |
| 13C3-HFPO-DA | | 75 | 40-130 |
| 13C3-PFBS | | 80 | 40-135 |
| 13C3-PFHxS | | 84 | 40-130 |
| 13C4-PFBA | | 79 | 5-130 |
| 13C4-PFHpA | | 74 | 40-130 |
| 13C5-PFHxA | | 76 | 40-130 |
| 13C5-PFPeA | | 80 | 40-130 |
| 13C6-PFDA | | 78 | 40-130 |
| 13C7-PFUnA | | 79 | 30-130 |
| 13C8-PFOA | | 72 | 40-130 |
| 13C8-PFOS | | 77 | 40-130 |
| 13C8-PFOSA | | 63 | 40-130 |
| 13C9-PFNA | | 78 | 40-130 |
| D3-NMeFOSA | | 38 | 10-130 |
| D3-NMeFOSAA | | 75 | 40-170 |
| D5-NEtFOSA | | 40 | 10-130 |
| D5-NEtFOSAA | | 63 | 25-135 |
| D7-NMeFOSE | | 54 | 10-130 |
| D9-NEtFOSE | | 55 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ15907-102
Batch: 15907
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 6.7 | | 1 | 88 | 55-160 | 08/19/2024 2112 |
| 9Cl-PF3ONS | 7.5 | 7.4 | | 1 | 99 | 70-155 | 08/19/2024 2112 |
| ADONA | 7.6 | 7.8 | | 1 | 103 | 65-145 | 08/19/2024 2112 |
| 8:2FTS | 7.7 | 8.7 | | 1 | 114 | 60-150 | 08/19/2024 2112 |
| 4:2FTS | 7.5 | 7.8 | | 1 | 104 | 70-145 | 08/19/2024 2112 |
| 6:2FTS | 7.6 | 7.9 | | 1 | 103 | 65-155 | 08/19/2024 2112 |
| 5:3FTCA | 50 | 51 | | 1 | 101 | 70-135 | 08/19/2024 2112 |
| HFPO-DA | 8.0 | 9.9 | | 1 | 124 | 70-140 | 08/19/2024 2112 |
| NEtFOSA | 2.0 | 2.0 | | 1 | 101 | 65-145 | 08/19/2024 2112 |
| NEtFOSAA | 2.0 | 1.8 | M-03 | 1 | 92 | 70-145 | 08/19/2024 2112 |
| NEtFOSE | 20 | 20 | | 1 | 99 | 70-135 | 08/19/2024 2112 |
| NMeFOSA | 2.0 | 2.0 | M-03 | 1 | 100 | 60-150 | 08/19/2024 2112 |
| NMeFOSAA | 2.0 | 1.6 | M-03 | 1 | 81 | 50-140 | 08/19/2024 2112 |
| NMeFOSE | 20 | 18 | | 1 | 92 | 70-145 | 08/19/2024 2112 |
| NFDHA | 4.0 | 4.2 | | 1 | 105 | 50-150 | 08/19/2024 2112 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.5 | | 1 | 99 | 70-140 | 08/19/2024 2112 |
| PFMPA | 4.0 | 4.5 | | 1 | 113 | 55-140 | 08/19/2024 2112 |
| PFMBA | 4.0 | 4.0 | | 1 | 99 | 60-150 | 08/19/2024 2112 |
| PFBS | 1.8 | 1.8 | M-03 | 1 | 102 | 60-145 | 08/19/2024 2112 |
| PFBA | 8.0 | 7.8 | M-03 | 1 | 98 | 70-140 | 08/19/2024 2112 |
| PFDS | 1.9 | 1.7 | | 1 | 86 | 60-145 | 08/19/2024 2112 |
| PFDA | 2.0 | 2.0 | M-03 | 1 | 99 | 70-140 | 08/19/2024 2112 |
| PFDoS | 1.9 | 1.6 | | 1 | 83 | 50-145 | 08/19/2024 2112 |
| PFDoA | 2.0 | 1.9 | | 1 | 93 | 70-140 | 08/19/2024 2112 |
| PFHpS | 1.9 | 1.9 | | 1 | 98 | 70-150 | 08/19/2024 2112 |
| PFHpA | 2.0 | 2.0 | | 1 | 102 | 70-150 | 08/19/2024 2112 |
| 7:3FTCA | 50 | 44 | | 1 | 87 | 50-145 | 08/19/2024 2112 |
| PFHxS | 1.8 | 2.0 | | 1 | 108 | 65-145 | 08/19/2024 2112 |
| PFHxA | 2.0 | 1.9 | | 1 | 96 | 70-145 | 08/19/2024 2112 |
| PFNS | 1.9 | 1.9 | M-03 | 1 | 98 | 65-145 | 08/19/2024 2112 |
| PFNA | 2.0 | 2.0 | | 1 | 101 | 70-150 | 08/19/2024 2112 |
| PFOSA | 2.0 | 2.1 | | 1 | 105 | 70-145 | 08/19/2024 2112 |
| PFOS | 1.9 | 1.8 | M-03 | 1 | 98 | 55-150 | 08/19/2024 2112 |
| PFOA | 2.0 | 2.2 | M-03 | 1 | 110 | 70-150 | 08/19/2024 2112 |
| PFPeS | 1.9 | 1.8 | | 1 | 94 | 65-140 | 08/19/2024 2112 |
| PFPeA | 4.0 | 3.9 | | 1 | 97 | 65-135 | 08/19/2024 2112 |
| 3:3FTCA | 10 | 11 | | 1 | 113 | 65-130 | 08/19/2024 2112 |
| PFTeDA | 2.0 | 2.1 | M-03 | 1 | 106 | 60-140 | 08/19/2024 2112 |
| PFTrDA | 2.0 | 2.2 | M-03 | 1 | 109 | 65-140 | 08/19/2024 2112 |
| PFUnA | 2.0 | 2.0 | M-03 | 1 | 99 | 70-145 | 08/19/2024 2112 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 68 | 40-200 |
| 13C2-6:2FTS | | 71 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ15907-102
Batch: 15907
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 61 | 40-300 |
| 13C2-PFDoA | | 62 | 10-130 |
| 13C2-PFTeDA | | 52 | 10-130 |
| 13C3-HFPO-DA | | 66 | 40-130 |
| 13C3-PFBS | | 67 | 40-135 |
| 13C3-PFHxS | | 69 | 40-130 |
| 13C4-PFBA | | 69 | 5-130 |
| 13C4-PFHpA | | 65 | 40-130 |
| 13C5-PFHxA | | 66 | 40-130 |
| 13C5-PFPeA | | 67 | 40-130 |
| 13C6-PFDA | | 65 | 40-130 |
| 13C7-PFUnA | | 66 | 30-130 |
| 13C8-PFOA | | 65 | 40-130 |
| 13C8-PFOS | | 65 | 40-130 |
| 13C8-PFOSA | | 57 | 40-130 |
| 13C9-PFNA | | 71 | 40-130 |
| D3-NMeFOSA | | 31 | 10-130 |
| D3-NMeFOSAA | | 64 | 40-170 |
| D5-NEtFOSA | | 32 | 10-130 |
| D5-NEtFOSAA | | 56 | 25-135 |
| D7-NMeFOSE | | 48 | 10-130 |
| D9-NEtFOSE | | 47 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ15908-001
Batch: 15908
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 08/23/2024 0039 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 08/23/2024 0039 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 08/23/2024 0039 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 08/23/2024 0039 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 08/23/2024 0039 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 08/23/2024 0039 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 08/23/2024 0039 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 08/23/2024 0039 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 08/23/2024 0039 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/23/2024 0039 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 08/23/2024 0039 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 08/23/2024 0039 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/23/2024 0039 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 08/23/2024 0039 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 08/23/2024 0039 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 08/23/2024 0039 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 08/23/2024 0039 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 08/23/2024 0039 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 08/23/2024 0039 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 08/23/2024 0039 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 08/23/2024 0039 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/23/2024 0039 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 08/23/2024 0039 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 08/23/2024 0039 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 08/23/2024 0039 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/23/2024 0039 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 08/23/2024 0039 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 08/23/2024 0039 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/23/2024 0039 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 08/23/2024 0039 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 08/23/2024 0039 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 08/23/2024 0039 |
| PFOS | 0.28 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 08/23/2024 0039 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/23/2024 0039 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 08/23/2024 0039 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 08/23/2024 0039 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 08/23/2024 0039 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 08/23/2024 0039 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 08/23/2024 0039 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 08/23/2024 0039 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 83 | 40-200 |
| 13C2-6:2FTS | | 80 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MB

Sample ID: ZQ15908-001
Batch: 15908
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 81 | 40-300 |
| 13C2-PFDoA | | 62 | 10-130 |
| 13C2-PFTeDA | | 56 | 10-130 |
| 13C3-HFPO-DA | | 78 | 40-130 |
| 13C3-PFBS | | 84 | 40-135 |
| 13C3-PFHxS | | 83 | 40-130 |
| 13C4-PFBA | | 84 | 5-130 |
| 13C4-PFHpA | | 80 | 40-130 |
| 13C5-PFHxA | | 78 | 40-130 |
| 13C5-PFPeA | | 81 | 40-130 |
| 13C6-PFDA | | 71 | 40-130 |
| 13C7-PFUnA | | 64 | 30-130 |
| 13C8-PFOA | | 96 | 40-130 |
| 13C8-PFOS | | 80 | 40-130 |
| 13C8-PFOSA | | 69 | 40-130 |
| 13C9-PFNA | | 80 | 40-130 |
| D3-NMeFOSA | | 34 | 10-130 |
| D3-NMeFOSAA | | 80 | 40-170 |
| D5-NEtFOSA | | 34 | 10-130 |
| D5-NEtFOSAA | | 75 | 25-135 |
| D7-NMeFOSE | | 53 | 10-130 |
| D9-NEtFOSE | | 50 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ15908-002
Batch: 15908
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 91 | | 1 | 100 | 55-160 | 08/23/2024 0048 |
| 9Cl-PF3ONS | 90 | 100 | | 1 | 115 | 70-155 | 08/23/2024 0048 |
| ADONA | 91 | 100 | | 1 | 111 | 65-145 | 08/23/2024 0048 |
| 8:2FTS | 92 | 98 | | 1 | 106 | 60-150 | 08/23/2024 0048 |
| 4:2FTS | 90 | 93 | | 1 | 103 | 70-145 | 08/23/2024 0048 |
| 6:2FTS | 91 | 99 | | 1 | 109 | 65-155 | 08/23/2024 0048 |
| 5:3FTCA | 600 | 620 | | 1 | 104 | 70-135 | 08/23/2024 0048 |
| HFPO-DA | 96 | 100 | | 1 | 106 | 70-140 | 08/23/2024 0048 |
| NEtFOSA | 24 | 26 | | 1 | 109 | 65-145 | 08/23/2024 0048 |
| NEtFOSAA | 24 | 27 | M-03 | 1 | 113 | 70-145 | 08/23/2024 0048 |
| NEtFOSE | 240 | 250 | | 1 | 104 | 70-135 | 08/23/2024 0048 |
| NMeFOSA | 24 | 27 | | 1 | 111 | 60-150 | 08/23/2024 0048 |
| NMeFOSAA | 24 | 24 | | 1 | 99 | 50-140 | 08/23/2024 0048 |
| NMeFOSE | 240 | 250 | | 1 | 106 | 70-145 | 08/23/2024 0048 |
| NFDHA | 48 | 48 | | 1 | 99 | 50-150 | 08/23/2024 0048 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 49 | | 1 | 115 | 70-140 | 08/23/2024 0048 |
| PFMPA | 48 | 56 | | 1 | 117 | 55-140 | 08/23/2024 0048 |
| PFMBA | 48 | 50 | | 1 | 105 | 60-150 | 08/23/2024 0048 |
| PFBS | 21 | 22 | | 1 | 102 | 60-145 | 08/23/2024 0048 |
| PFBA | 96 | 99 | | 1 | 103 | 70-140 | 08/23/2024 0048 |
| PFDS | 23 | 21 | | 1 | 91 | 60-145 | 08/23/2024 0048 |
| PFDA | 24 | 25 | | 1 | 102 | 70-140 | 08/23/2024 0048 |
| PFDoS | 23 | 19 | | 1 | 81 | 50-145 | 08/23/2024 0048 |
| PFDoA | 24 | 24 | | 1 | 102 | 70-140 | 08/23/2024 0048 |
| PFHpS | 23 | 24 | | 1 | 105 | 70-150 | 08/23/2024 0048 |
| PFHpA | 24 | 24 | | 1 | 101 | 70-150 | 08/23/2024 0048 |
| 7:3FTCA | 600 | 610 | | 1 | 102 | 50-145 | 08/23/2024 0048 |
| PFHxS | 22 | 19 | | 1 | 86 | 65-145 | 08/23/2024 0048 |
| PFHxA | 24 | 25 | | 1 | 105 | 70-145 | 08/23/2024 0048 |
| PFNS | 23 | 24 | | 1 | 103 | 65-145 | 08/23/2024 0048 |
| PFNA | 24 | 23 | | 1 | 97 | 70-150 | 08/23/2024 0048 |
| PFOSA | 24 | 26 | | 1 | 110 | 70-145 | 08/23/2024 0048 |
| PFOS | 22 | 23 | M-03 | 1 | 103 | 55-150 | 08/23/2024 0048 |
| PFOA | 24 | 21 | | 1 | 89 | 70-150 | 08/23/2024 0048 |
| PFPeS | 23 | 21 | | 1 | 92 | 65-140 | 08/23/2024 0048 |
| PFPeA | 48 | 49 | | 1 | 103 | 65-135 | 08/23/2024 0048 |
| 3:3FTCA | 120 | 120 | | 1 | 103 | 65-130 | 08/23/2024 0048 |
| PFTeDA | 24 | 25 | | 1 | 106 | 60-140 | 08/23/2024 0048 |
| PFTrDA | 24 | 24 | | 1 | 100 | 65-140 | 08/23/2024 0048 |
| PFUnA | 24 | 28 | | 1 | 116 | 70-145 | 08/23/2024 0048 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 68 | 40-200 |
| 13C2-6:2FTS | | 65 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ15908-002
Batch: 15908
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 62 | 40-300 |
| 13C2-PFDoA | | 60 | 10-130 |
| 13C2-PFTeDA | | 54 | 10-130 |
| 13C3-HFPO-DA | | 73 | 40-130 |
| 13C3-PFBS | | 66 | 40-135 |
| 13C3-PFHxS | | 72 | 40-130 |
| 13C4-PFBA | | 78 | 5-130 |
| 13C4-PFHpA | | 75 | 40-130 |
| 13C5-PFHxA | | 74 | 40-130 |
| 13C5-PFPeA | | 74 | 40-130 |
| 13C6-PFDA | | 75 | 40-130 |
| 13C7-PFUnA | | 62 | 30-130 |
| 13C8-PFOA | | 78 | 40-130 |
| 13C8-PFOS | | 69 | 40-130 |
| 13C8-PFOSA | | 60 | 40-130 |
| 13C9-PFNA | | 75 | 40-130 |
| D3-NMeFOSA | | 38 | 10-130 |
| D3-NMeFOSAA | | 72 | 40-170 |
| D5-NEtFOSA | | 38 | 10-130 |
| D5-NEtFOSAA | | 65 | 25-135 |
| D7-NMeFOSE | | 50 | 10-130 |
| D9-NEtFOSE | | 50 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ15908-102
Batch: 15908
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.9 | | 1 | 104 | 55-160 | 08/24/2024 1840 |
| 9Cl-PF3ONS | 7.5 | 8.0 | | 1 | 107 | 70-155 | 08/24/2024 1840 |
| ADONA | 7.6 | 8.0 | | 1 | 106 | 65-145 | 08/24/2024 1840 |
| 8:2FTS | 7.7 | 6.5 | M-03 | 1 | 85 | 60-150 | 08/24/2024 1840 |
| 4:2FTS | 7.5 | 8.2 | | 1 | 110 | 70-145 | 08/24/2024 1840 |
| 6:2FTS | 7.6 | 9.6 | | 1 | 127 | 65-155 | 08/24/2024 1840 |
| 5:3FTCA | 50 | 52 | | 1 | 103 | 70-135 | 08/24/2024 1840 |
| HFPO-DA | 8.0 | 8.5 | | 1 | 106 | 70-140 | 08/24/2024 1840 |
| NEtFOSA | 2.0 | 2.0 | M-03 | 1 | 99 | 65-145 | 08/24/2024 1840 |
| NEtFOSAA | 2.0 | 2.1 | M-03 | 1 | 106 | 70-145 | 08/24/2024 1840 |
| NEtFOSE | 20 | 20 | | 1 | 99 | 70-135 | 08/24/2024 1840 |
| NMeFOSA | 2.0 | 2.1 | M-03 | 1 | 103 | 60-150 | 08/24/2024 1840 |
| NMeFOSAA | 2.0 | 1.9 | M-03 | 1 | 97 | 50-140 | 08/24/2024 1840 |
| NMeFOSE | 20 | 20 | | 1 | 100 | 70-145 | 08/24/2024 1840 |
| NFDHA | 4.0 | 4.1 | | 1 | 103 | 50-150 | 08/24/2024 1840 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.6 | | 1 | 102 | 70-140 | 08/24/2024 1840 |
| PFMPA | 4.0 | 4.2 | | 1 | 104 | 55-140 | 08/24/2024 1840 |
| PFMBA | 4.0 | 3.8 | | 1 | 95 | 60-150 | 08/24/2024 1840 |
| PFBS | 1.8 | 1.8 | | 1 | 99 | 60-145 | 08/24/2024 1840 |
| PFBA | 8.0 | 8.2 | M-03 | 1 | 103 | 70-140 | 08/24/2024 1840 |
| PFDS | 1.9 | 1.9 | M-03 | 1 | 100 | 60-145 | 08/24/2024 1840 |
| PFDA | 2.0 | 2.1 | M-03 | 1 | 106 | 70-140 | 08/24/2024 1840 |
| PFDoS | 1.9 | 1.8 | M-03 | 1 | 93 | 50-145 | 08/24/2024 1840 |
| PFDoA | 2.0 | 2.1 | | 1 | 107 | 70-140 | 08/24/2024 1840 |
| PFHpS | 1.9 | 2.0 | M-03 | 1 | 103 | 70-150 | 08/24/2024 1840 |
| PFHpA | 2.0 | 1.9 | | 1 | 96 | 70-150 | 08/24/2024 1840 |
| 7:3FTCA | 50 | 48 | | 1 | 96 | 50-145 | 08/24/2024 1840 |
| PFHxS | 1.8 | 1.7 | | 1 | 94 | 65-145 | 08/24/2024 1840 |
| PFHxA | 2.0 | 2.2 | M-03 | 1 | 111 | 70-145 | 08/24/2024 1840 |
| PFNS | 1.9 | 2.1 | | 1 | 108 | 65-145 | 08/24/2024 1840 |
| PFNA | 2.0 | 1.9 | M-03 | 1 | 95 | 70-150 | 08/24/2024 1840 |
| PFOSA | 2.0 | 2.1 | | 1 | 105 | 70-145 | 08/24/2024 1840 |
| PFOS | 1.9 | 1.9 | | 1 | 105 | 55-150 | 08/24/2024 1840 |
| PFOA | 2.0 | 2.0 | M-03 | 1 | 101 | 70-150 | 08/24/2024 1840 |
| PFPeS | 1.9 | 1.8 | | 1 | 97 | 65-140 | 08/24/2024 1840 |
| PFPeA | 4.0 | 3.9 | | 1 | 96 | 65-135 | 08/24/2024 1840 |
| 3:3FTCA | 10 | 11 | M-03 | 1 | 109 | 65-130 | 08/24/2024 1840 |
| PFTeDA | 2.0 | 1.8 | M-03 | 1 | 92 | 60-140 | 08/24/2024 1840 |
| PFTrDA | 2.0 | 1.8 | | 1 | 89 | 65-140 | 08/24/2024 1840 |
| PFUnA | 2.0 | 2.2 | M-03 | 1 | 112 | 70-145 | 08/24/2024 1840 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 77 | 40-200 |
| 13C2-6:2FTS | | 69 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ15908-102
Batch: 15908
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 78 | 40-300 |
| 13C2-PFDoA | | 68 | 10-130 |
| 13C2-PFTeDA | | 64 | 10-130 |
| 13C3-HFPO-DA | | 82 | 40-130 |
| 13C3-PFBS | | 83 | 40-135 |
| 13C3-PFHxS | | 81 | 40-130 |
| 13C4-PFBA | | 83 | 5-130 |
| 13C4-PFHpA | | 87 | 40-130 |
| 13C5-PFHxA | | 86 | 40-130 |
| 13C5-PFPeA | | 87 | 40-130 |
| 13C6-PFDA | | 79 | 40-130 |
| 13C7-PFUnA | | 73 | 30-130 |
| 13C8-PFOA | | 86 | 40-130 |
| 13C8-PFOS | | 75 | 40-130 |
| 13C8-PFOSA | | 76 | 40-130 |
| 13C9-PFNA | | 78 | 40-130 |
| D3-NMeFOSA | | 42 | 10-130 |
| D3-NMeFOSAA | | 79 | 40-170 |
| D5-NEtFOSA | | 44 | 10-130 |
| D5-NEtFOSAA | | 76 | 25-135 |
| D7-NMeFOSE | | 61 | 10-130 |
| D9-NEtFOSE | | 60 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZG19017-018MS
Batch: 15908
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 81 | 42 | N | 1 | 51 | 55-160 | 08/23/2024 0316 |
| 9Cl-PF3ONS | ND | 80 | 72 | | 1 | 90 | 70-155 | 08/23/2024 0316 |
| ADONA | ND | 81 | 78 | | 1 | 95 | 65-145 | 08/23/2024 0316 |
| 8:2FTS | 5.7 | 83 | 74 | | 1 | 83 | 60-150 | 08/23/2024 0316 |
| 4:2FTS | ND | 81 | 78 | | 1 | 96 | 70-145 | 08/23/2024 0316 |
| 6:2FTS | 2.5 | 82 | 93 | | 1 | 111 | 65-155 | 08/23/2024 0316 |
| 5:3FTCA | ND | 540 | 500 | | 1 | 92 | 70-135 | 08/23/2024 0316 |
| HFPO-DA | ND | 86 | 73 | | 1 | 84 | 70-140 | 08/23/2024 0316 |
| NEtFOSA | ND | 22 | 24 | | 1 | 112 | 65-145 | 08/23/2024 0316 |
| NEtFOSAA | ND | 22 | 21 | M-03 | 1 | 97 | 70-145 | 08/23/2024 0316 |
| NEtFOSE | ND | 220 | 210 | | 1 | 99 | 70-135 | 08/23/2024 0316 |
| NMeFOSA | ND | 22 | 24 | | 1 | 109 | 60-150 | 08/23/2024 0316 |
| NMeFOSAA | ND | 22 | 20 | M-03 | 1 | 92 | 50-140 | 08/23/2024 0316 |
| NMeFOSE | ND | 220 | 220 | | 1 | 101 | 70-145 | 08/23/2024 0316 |
| NFDHA | ND | 43 | 44 | | 1 | 101 | 50-150 | 08/23/2024 0316 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 38 | 44 | | 1 | 115 | 70-140 | 08/23/2024 0316 |
| PFMPA | ND | 43 | 43 | | 1 | 100 | 55-140 | 08/23/2024 0316 |
| PFMBA | ND | 43 | 43 | | 1 | 100 | 60-150 | 08/23/2024 0316 |
| PFBS | 6.0 | 19 | 25 | | 1 | 99 | 60-145 | 08/23/2024 0316 |
| PFBA | 8.1 | 86 | 90 | | 1 | 95 | 70-140 | 08/23/2024 0316 |
| PFDS | ND | 21 | 16 | | 1 | 79 | 60-145 | 08/23/2024 0316 |
| PFDA | ND | 22 | 20 | | 1 | 93 | 70-140 | 08/23/2024 0316 |
| PFDoS | ND | 21 | 9.2 | N | 1 | 44 | 50-145 | 08/23/2024 0316 |
| PFDoA | ND | 22 | 19 | | 1 | 88 | 70-140 | 08/23/2024 0316 |
| PFHpS | 12 | 21 | 37 | | 1 | 122 | 70-150 | 08/23/2024 0316 |
| PFHpA | 9.2 | 22 | 29 | | 1 | 90 | 70-150 | 08/23/2024 0316 |
| 7:3FTCA | ND | 540 | 370 | | 1 | 69 | 50-145 | 08/23/2024 0316 |
| PFHxS | 150 | 20 | 160 | NM-03 | 1 | 40 | 65-145 | 08/23/2024 0316 |
| PFHxA | 14 | 22 | 35 | | 1 | 97 | 70-145 | 08/23/2024 0316 |
| PFNS | ND | 21 | 22 | | 1 | 108 | 65-145 | 08/23/2024 0316 |
| PFNA | 3.6 | 22 | 24 | | 1 | 94 | 70-150 | 08/23/2024 0316 |
| PFOSA | 1.1 | 22 | 22 | M-03 | 1 | 97 | 70-145 | 08/23/2024 0316 |
| PFOS | 750 | 20 | 770 | EM-03 | 1 | 129 | 55-150 | 08/23/2024 0316 |
| PFOA | 23 | 22 | 44 | M-03 | 1 | 96 | 70-150 | 08/23/2024 0316 |
| PFPeS | 9.2 | 20 | 29 | | 1 | 100 | 65-140 | 08/23/2024 0316 |
| PFPeA | 10 | 43 | 51 | | 1 | 95 | 65-135 | 08/23/2024 0316 |
| 3:3FTCA | ND | 110 | 87 | | 1 | 81 | 65-130 | 08/23/2024 0316 |
| PFTeDA | ND | 22 | 22 | | 1 | 102 | 60-140 | 08/23/2024 0316 |
| PFTrDA | ND | 22 | 15 | | 1 | 70 | 65-140 | 08/23/2024 0316 |
| PFUnA | ND | 22 | 25 | | 1 | 114 | 70-145 | 08/23/2024 0316 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 75 | 40-200 |
| 13C2-6:2FTS | | 73 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MS

Sample ID: ZG19017-018MS
Batch: 15908
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 70 | 40-300 |
| 13C2-PFDoA | | 40 | 10-130 |
| 13C2-PFTeDA | | 23 | 10-130 |
| 13C3-HFPO-DA | | 74 | 40-130 |
| 13C3-PFBS | | 76 | 40-135 |
| 13C3-PFHxS | | 76 | 40-130 |
| 13C4-PFBA | | 76 | 5-130 |
| 13C4-PFHpA | | 76 | 40-130 |
| 13C5-PFHxA | | 72 | 40-130 |
| 13C5-PFPeA | | 76 | 40-130 |
| 13C6-PFDA | | 71 | 40-130 |
| 13C7-PFUnA | | 49 | 30-130 |
| 13C8-PFOA | | 75 | 40-130 |
| 13C8-PFOS | | 61 | 40-130 |
| 13C8-PFOSA | | 56 | 40-130 |
| 13C9-PFNA | | 74 | 40-130 |
| D3-NMeFOSA | | 29 | 10-130 |
| D3-NMeFOSAA | | 52 | 40-170 |
| D5-NEtFOSA | | 25 | 10-130 |
| D5-NEtFOSAA | | 39 | 25-135 |
| D7-NMeFOSE | | 35 | 10-130 |
| D9-NEtFOSE | | 30 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MSD

Sample ID: ZG19017-018MD
Batch: 15908
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Parameter | Sample Amount (ng/L) | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | % RPD | %Rec Limit | % RPD Limit | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | ND | 81 | 55 | | 1 | 68 | 28 | 55-160 | 30 | 08/23/2024 0325 |
| 9Cl-PF3ONS | ND | 80 | 90 | | 1 | 113 | 22 | 70-155 | 30 | 08/23/2024 0325 |
| ADONA | ND | 81 | 95 | | 1 | 117 | 20 | 65-145 | 30 | 08/23/2024 0325 |
| 8:2FTS | 5.7 | 82 | 88 | | 1 | 101 | 18 | 60-150 | 30 | 08/23/2024 0325 |
| 4:2FTS | ND | 80 | 77 | | 1 | 97 | 0.65 | 70-145 | 30 | 08/23/2024 0325 |
| 6:2FTS | 2.5 | 81 | 74 | | 1 | 88 | 24 | 65-155 | 30 | 08/23/2024 0325 |
| 5:3FTCA | ND | 530 | 460 | | 1 | 86 | 7.6 | 70-135 | 30 | 08/23/2024 0325 |
| HFPO-DA | ND | 85 | 88 | | 1 | 103 | 19 | 70-140 | 30 | 08/23/2024 0325 |
| NEtFOSA | ND | 21 | 20 | | 1 | 95 | 17 | 65-145 | 30 | 08/23/2024 0325 |
| NEtFOSAA | ND | 21 | 20 | M-03 | 1 | 94 | 3.8 | 70-145 | 30 | 08/23/2024 0325 |
| NEtFOSE | ND | 210 | 200 | | 1 | 94 | 5.4 | 70-135 | 30 | 08/23/2024 0325 |
| NMeFOSA | ND | 21 | 22 | | 1 | 105 | 5.1 | 60-150 | 30 | 08/23/2024 0325 |
| NMeFOSAA | ND | 21 | 20 | M-03 | 1 | 95 | 2.8 | 50-140 | 30 | 08/23/2024 0325 |
| NMeFOSE | ND | 210 | 200 | | 1 | 92 | 11 | 70-145 | 30 | 08/23/2024 0325 |
| NFDHA | ND | 43 | 39 | | 1 | 92 | 11 | 50-150 | 30 | 08/23/2024 0325 |
| 2-ethoxyethane)sulfonic acid (PFEESA | ND | 38 | 41 | | 1 | 109 | 6.0 | 70-140 | 30 | 08/23/2024 0325 |
| PFMPA | ND | 43 | 42 | | 1 | 98 | 3.5 | 55-140 | 30 | 08/23/2024 0325 |
| PFMBA | ND | 43 | 40 | | 1 | 93 | 7.6 | 60-150 | 30 | 08/23/2024 0325 |
| PFBS | 6.0 | 19 | 23 | | 1 | 89 | 8.8 | 60-145 | 30 | 08/23/2024 0325 |
| PFBA | 8.1 | 85 | 87 | | 1 | 93 | 3.3 | 70-140 | 30 | 08/23/2024 0325 |
| PFDS | ND | 21 | 13 | | 1 | 65 | 20 | 60-145 | 30 | 08/23/2024 0325 |
| PFDA | ND | 21 | 21 | | 1 | 97 | 3.7 | 70-140 | 30 | 08/23/2024 0325 |
| PFDoS | ND | 21 | 10 | N | 1 | 48 | 8.6 | 50-145 | 30 | 08/23/2024 0325 |
| PFDoA | ND | 21 | 21 | | 1 | 97 | 7.8 | 70-140 | 30 | 08/23/2024 0325 |
| PFHpS | 12 | 20 | 28 | | 1 | 78 | 28 | 70-150 | 30 | 08/23/2024 0325 |
| PFHpA | 9.2 | 21 | 30 | | 1 | 97 | 4.9 | 70-150 | 30 | 08/23/2024 0325 |
| 7:3FTCA | ND | 530 | 320 | | 1 | 59 | 16 | 50-145 | 30 | 08/23/2024 0325 |
| PFHxS | 150 | 19 | 140 | NM-03 | 1 | -51 | 12 | 65-145 | 30 | 08/23/2024 0325 |
| PFHxA | 14 | 21 | 32 | | 1 | 86 | 7.7 | 70-145 | 30 | 08/23/2024 0325 |
| PFNS | ND | 21 | 18 | | 1 | 90 | 20 | 65-145 | 30 | 08/23/2024 0325 |
| PFNA | 3.6 | 21 | 22 | | 1 | 87 | 7.6 | 70-150 | 30 | 08/23/2024 0325 |
| PFOSA | 1.1 | 21 | 22 | M-03 | 1 | 96 | 2.1 | 70-145 | 30 | 08/23/2024 0325 |
| PFOS | 750 | 20 | 580 | NM-03 | 1 | -836 | 28 | 55-150 | 30 | 08/23/2024 0325 |
| PFOA | 23 | 21 | 41 | M-03 | 1 | 85 | 6.0 | 70-150 | 30 | 08/23/2024 0325 |
| PFPeS | 9.2 | 20 | 27 | | 1 | 89 | 8.6 | 65-140 | 30 | 08/23/2024 0325 |
| PFPeA | 10 | 43 | 48 | | 1 | 89 | 6.3 | 65-135 | 30 | 08/23/2024 0325 |
| 3:3FTCA | ND | 110 | 87 | | 1 | 81 | 0.12 | 65-130 | 30 | 08/23/2024 0325 |
| PFTeDA | ND | 21 | 22 | | 1 | 102 | 1.3 | 60-140 | 30 | 08/23/2024 0325 |
| PFTrDA | ND | 21 | 18 | | 1 | 85 | 18 | 65-140 | 30 | 08/23/2024 0325 |
| PFUnA | ND | 21 | 21 | M-03 | 1 | 101 | 13 | 70-145 | 30 | 08/23/2024 0325 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 76 | 40-200 |
| 13C2-6:2FTS | | 80 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - MSD

Sample ID: ZG19017-018MD
Batch: 15908
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/09/2024 1707

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 65 | 40-300 |
| 13C2-PFDoA | | 39 | 10-130 |
| 13C2-PFTeDA | | 30 | 10-130 |
| 13C3-HFPO-DA | | 78 | 40-130 |
| 13C3-PFBS | | 84 | 40-135 |
| 13C3-PFHxS | | 82 | 40-130 |
| 13C4-PFBA | | 79 | 5-130 |
| 13C4-PFHpA | | 82 | 40-130 |
| 13C5-PFHxA | | 78 | 40-130 |
| 13C5-PFPeA | | 82 | 40-130 |
| 13C6-PFDA | | 63 | 40-130 |
| 13C7-PFUnA | | 50 | 30-130 |
| 13C8-PFOA | | 83 | 40-130 |
| 13C8-PFOS | | 76 | 40-130 |
| 13C8-PFOSA | | 53 | 40-130 |
| 13C9-PFNA | | 78 | 40-130 |
| D3-NMeFOSA | | 27 | 10-130 |
| D3-NMeFOSAA | | 52 | 40-170 |
| D5-NEtFOSA | | 25 | 10-130 |
| D5-NEtFOSAA | | 42 | 25-135 |
| D7-NMeFOSE | | 36 | 10-130 |
| D9-NEtFOSE | | 32 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16000-001
Batch: 16000
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/10/2024 1144

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 08/13/2024 1116 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 08/13/2024 1116 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 08/13/2024 1116 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 08/13/2024 1116 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 08/13/2024 1116 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 08/13/2024 1116 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 08/13/2024 1116 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 08/13/2024 1116 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 08/13/2024 1116 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/13/2024 1116 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 08/13/2024 1116 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 08/13/2024 1116 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/13/2024 1116 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 08/13/2024 1116 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 08/13/2024 1116 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 08/13/2024 1116 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 08/13/2024 1116 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 08/13/2024 1116 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 08/13/2024 1116 |
| PFBA | 1.6 | UM-03 | 1 | 4.0 | 1.6 | 0.51 | ng/L | 08/13/2024 1116 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 08/13/2024 1116 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/13/2024 1116 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 08/13/2024 1116 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 08/13/2024 1116 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 08/13/2024 1116 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/13/2024 1116 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 08/13/2024 1116 |
| PFHxS | 0.73 | UM-03 | 1 | 1.0 | 0.73 | 0.18 | ng/L | 08/13/2024 1116 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/13/2024 1116 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 08/13/2024 1116 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 08/13/2024 1116 |
| PFOSA | 0.40 | UM-03 | 1 | 1.0 | 0.40 | 0.20 | ng/L | 08/13/2024 1116 |
| PFOS | 0.74 | UM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 08/13/2024 1116 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/13/2024 1116 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 08/13/2024 1116 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 08/13/2024 1116 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 08/13/2024 1116 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 08/13/2024 1116 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 08/13/2024 1116 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 08/13/2024 1116 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 87 | 40-200 |
| 13C2-6:2FTS | | 85 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16000-001
Batch: 16000
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/10/2024 1144

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | M-03 | 78 | 40-300 |
| 13C2-PFDoA | | 65 | 10-130 |
| 13C2-PFTeDA | | 58 | 10-130 |
| 13C3-HFPO-DA | | 88 | 40-130 |
| 13C3-PFBS | | 88 | 40-135 |
| 13C3-PFHxS | | 92 | 40-130 |
| 13C4-PFBA | | 89 | 5-130 |
| 13C4-PFHpA | | 88 | 40-130 |
| 13C5-PFHxA | | 86 | 40-130 |
| 13C5-PFPeA | | 91 | 40-130 |
| 13C6-PFDA | | 64 | 40-130 |
| 13C7-PFUnA | | 69 | 30-130 |
| 13C8-PFOA | | 89 | 40-130 |
| 13C8-PFOS | | 78 | 40-130 |
| 13C8-PFOSA | | 79 | 40-130 |
| 13C9-PFNA | | 83 | 40-130 |
| D3-NMeFOSA | | 50 | 10-130 |
| D3-NMeFOSAA | | 73 | 40-170 |
| D5-NEtFOSA | | 52 | 10-130 |
| D5-NEtFOSAA | | 76 | 25-135 |
| D7-NMeFOSE | | 71 | 10-130 |
| D9-NEtFOSE | | 70 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16000-002
Batch: 16000
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/10/2024 1144

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 95 | 90 | | 1 | 95 | 55-160 | 08/13/2024 1125 |
| 9Cl-PF3ONS | 94 | 110 | | 1 | 113 | 70-155 | 08/13/2024 1125 |
| ADONA | 95 | 110 | | 1 | 113 | 65-145 | 08/13/2024 1125 |
| 8:2FTS | 96 | 120 | | 1 | 121 | 60-150 | 08/13/2024 1125 |
| 4:2FTS | 94 | 110 | | 1 | 115 | 70-145 | 08/13/2024 1125 |
| 6:2FTS | 95 | 120 | | 1 | 131 | 65-155 | 08/13/2024 1125 |
| 5:3FTCA | 630 | 660 | | 1 | 104 | 70-135 | 08/13/2024 1125 |
| HFPO-DA | 100 | 110 | | 1 | 109 | 70-140 | 08/13/2024 1125 |
| NEtFOSA | 25 | 27 | | 1 | 107 | 65-145 | 08/13/2024 1125 |
| NEtFOSAA | 25 | 26 | M-03 | 1 | 104 | 70-145 | 08/13/2024 1125 |
| NEtFOSE | 250 | 270 | | 1 | 108 | 70-135 | 08/13/2024 1125 |
| NMeFOSA | 25 | 29 | | 1 | 116 | 60-150 | 08/13/2024 1125 |
| NMeFOSAA | 25 | 28 | M-03 | 1 | 110 | 50-140 | 08/13/2024 1125 |
| NMeFOSE | 250 | 280 | | 1 | 113 | 70-145 | 08/13/2024 1125 |
| NFDHA | 50 | 50 | | 1 | 100 | 50-150 | 08/13/2024 1125 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 45 | 48 | | 1 | 108 | 70-140 | 08/13/2024 1125 |
| PFMPA | 50 | 59 | | 1 | 118 | 55-140 | 08/13/2024 1125 |
| PFMBA | 50 | 55 | | 1 | 109 | 60-150 | 08/13/2024 1125 |
| PFBS | 22 | 24 | | 1 | 108 | 60-145 | 08/13/2024 1125 |
| PFBA | 100 | 110 | M-03 | 1 | 112 | 70-140 | 08/13/2024 1125 |
| PFDS | 24 | 23 | | 1 | 95 | 60-145 | 08/13/2024 1125 |
| PFDA | 25 | 25 | | 1 | 99 | 70-140 | 08/13/2024 1125 |
| PFDoS | 24 | 18 | | 1 | 76 | 50-145 | 08/13/2024 1125 |
| PFDoA | 25 | 27 | | 1 | 107 | 70-140 | 08/13/2024 1125 |
| PFHpS | 24 | 27 | | 1 | 114 | 70-150 | 08/13/2024 1125 |
| PFHpA | 25 | 27 | | 1 | 108 | 70-150 | 08/13/2024 1125 |
| 7:3FTCA | 630 | 580 | | 1 | 93 | 50-145 | 08/13/2024 1125 |
| PFHxS | 23 | 24 | M-03 | 1 | 105 | 65-145 | 08/13/2024 1125 |
| PFHxA | 25 | 27 | | 1 | 106 | 70-145 | 08/13/2024 1125 |
| PFNS | 24 | 24 | | 1 | 101 | 65-145 | 08/13/2024 1125 |
| PFNA | 25 | 26 | | 1 | 104 | 70-150 | 08/13/2024 1125 |
| PFOSA | 25 | 25 | | 1 | 101 | 70-145 | 08/13/2024 1125 |
| PFOS | 23 | 25 | M-03 | 1 | 106 | 55-150 | 08/13/2024 1125 |
| PFOA | 25 | 25 | | 1 | 99 | 70-150 | 08/13/2024 1125 |
| PFPeS | 24 | 26 | | 1 | 109 | 65-140 | 08/13/2024 1125 |
| PFPeA | 50 | 53 | | 1 | 106 | 65-135 | 08/13/2024 1125 |
| 3:3FTCA | 130 | 130 | | 1 | 106 | 65-130 | 08/13/2024 1125 |
| PFTeDA | 25 | 28 | | 1 | 111 | 60-140 | 08/13/2024 1125 |
| PFTrDA | 25 | 24 | | 1 | 97 | 65-140 | 08/13/2024 1125 |
| PFUnA | 25 | 28 | | 1 | 112 | 70-145 | 08/13/2024 1125 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 88 | 40-200 |
| 13C2-6:2FTS | | 76 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16000-002
Batch: 16000
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/10/2024 1144

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 80 | 40-300 |
| 13C2-PFDoA | | 72 | 10-130 |
| 13C2-PFTeDA | | 54 | 10-130 |
| 13C3-HFPO-DA | | 84 | 40-130 |
| 13C3-PFBS | | 89 | 40-135 |
| 13C3-PFHxS | | 92 | 40-130 |
| 13C4-PFBA | | 91 | 5-130 |
| 13C4-PFHpA | | 87 | 40-130 |
| 13C5-PFHxA | | 87 | 40-130 |
| 13C5-PFPeA | | 88 | 40-130 |
| 13C6-PFDA | | 85 | 40-130 |
| 13C7-PFUnA | | 76 | 30-130 |
| 13C8-PFOA | | 91 | 40-130 |
| 13C8-PFOS | | 82 | 40-130 |
| 13C8-PFOSA | | 79 | 40-130 |
| 13C9-PFNA | | 88 | 40-130 |
| D3-NMeFOSA | | 49 | 10-130 |
| D3-NMeFOSAA | | 76 | 40-170 |
| D5-NEtFOSA | | 51 | 10-130 |
| D5-NEtFOSAA | | 74 | 25-135 |
| D7-NMeFOSE | | 69 | 10-130 |
| D9-NEtFOSE | | 70 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16000-102
Batch: 16000
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/10/2024 1144

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.9 | 8.9 | | 1 | 113 | 55-160 | 08/13/2024 1134 |
| 9Cl-PF3ONS | 7.8 | 9.8 | | 1 | 126 | 70-155 | 08/13/2024 1134 |
| ADONA | 7.9 | 9.6 | | 1 | 123 | 65-145 | 08/13/2024 1134 |
| 8:2FTS | 8.0 | 10 | M-03 | 1 | 126 | 60-150 | 08/13/2024 1134 |
| 4:2FTS | 7.8 | 8.6 | M-03 | 1 | 110 | 70-145 | 08/13/2024 1134 |
| 6:2FTS | 7.9 | 9.8 | | 1 | 125 | 65-155 | 08/13/2024 1134 |
| 5:3FTCA | 52 | 61 | | 1 | 117 | 70-135 | 08/13/2024 1134 |
| HFPO-DA | 8.3 | 10 | M-03 | 1 | 122 | 70-140 | 08/13/2024 1134 |
| NEtFOSA | 2.1 | 2.4 | | 1 | 115 | 65-145 | 08/13/2024 1134 |
| NEtFOSAA | 2.1 | 2.1 | M-03 | 1 | 102 | 70-145 | 08/13/2024 1134 |
| NEtFOSE | 21 | 23 | | 1 | 113 | 70-135 | 08/13/2024 1134 |
| NMeFOSA | 2.1 | 2.4 | M-03 | 1 | 115 | 60-150 | 08/13/2024 1134 |
| NMeFOSAA | 2.1 | 2.8 | M-03 | 1 | 133 | 50-140 | 08/13/2024 1134 |
| NMeFOSE | 21 | 24 | | 1 | 114 | 70-145 | 08/13/2024 1134 |
| NFDHA | 4.2 | 4.4 | M-03 | 1 | 106 | 50-150 | 08/13/2024 1134 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.7 | 4.2 | | 1 | 115 | 70-140 | 08/13/2024 1134 |
| PFMPA | 4.2 | 5.3 | M-03 | 1 | 128 | 55-140 | 08/13/2024 1134 |
| PFMBA | 4.2 | 4.9 | M-03 | 1 | 119 | 60-150 | 08/13/2024 1134 |
| PFBS | 1.8 | 2.2 | | 1 | 118 | 60-145 | 08/13/2024 1134 |
| PFBA | 8.3 | 9.9 | M-03 | 1 | 119 | 70-140 | 08/13/2024 1134 |
| PFDS | 2.0 | 2.0 | M-03 | 1 | 98 | 60-145 | 08/13/2024 1134 |
| PFDA | 2.1 | 2.2 | | 1 | 106 | 70-140 | 08/13/2024 1134 |
| PFDoS | 2.0 | 2.2 | | 1 | 108 | 50-145 | 08/13/2024 1134 |
| PFDoA | 2.1 | 2.4 | | 1 | 116 | 70-140 | 08/13/2024 1134 |
| PFHpS | 2.0 | 2.4 | | 1 | 121 | 70-150 | 08/13/2024 1134 |
| PFHpA | 2.1 | 2.2 | | 1 | 105 | 70-150 | 08/13/2024 1134 |
| 7:3FTCA | 52 | 60 | M-03 | 1 | 114 | 50-145 | 08/13/2024 1134 |
| PFHxS | 1.9 | 2.4 | M-03 | 1 | 125 | 65-145 | 08/13/2024 1134 |
| PFHxA | 2.1 | 2.4 | M-03 | 1 | 117 | 70-145 | 08/13/2024 1134 |
| PFNS | 2.0 | 2.3 | | 1 | 116 | 65-145 | 08/13/2024 1134 |
| PFNA | 2.1 | 2.4 | M-03 | 1 | 117 | 70-150 | 08/13/2024 1134 |
| PFOSA | 2.1 | 2.5 | | 1 | 121 | 70-145 | 08/13/2024 1134 |
| PFOS | 1.9 | 2.6 | M-03 | 1 | 135 | 55-150 | 08/13/2024 1134 |
| PFOA | 2.1 | 2.5 | M-03 | 1 | 120 | 70-150 | 08/13/2024 1134 |
| PFPeS | 2.0 | 2.2 | | 1 | 111 | 65-140 | 08/13/2024 1134 |
| PFPeA | 4.2 | 4.7 | | 1 | 113 | 65-135 | 08/13/2024 1134 |
| 3:3FTCA | 10 | 13 | | 1 | 121 | 65-130 | 08/13/2024 1134 |
| PFTeDA | 2.1 | 2.4 | | 1 | 114 | 60-140 | 08/13/2024 1134 |
| PFTrDA | 2.1 | 2.3 | | 1 | 113 | 65-140 | 08/13/2024 1134 |
| PFUnA | 2.1 | 2.4 | M-03 | 1 | 116 | 70-145 | 08/13/2024 1134 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 97 | 40-200 |
| 13C2-6:2FTS | | 86 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16000-102
Batch: 16000
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/10/2024 1144

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 84 | 40-300 |
| 13C2-PFDoA | | 74 | 10-130 |
| 13C2-PFTeDA | | 74 | 10-130 |
| 13C3-HFPO-DA | | 88 | 40-130 |
| 13C3-PFBS | | 95 | 40-135 |
| 13C3-PFHxS | | 96 | 40-130 |
| 13C4-PFBA | | 85 | 5-130 |
| 13C4-PFHpA | | 91 | 40-130 |
| 13C5-PFHxA | | 89 | 40-130 |
| 13C5-PFPeA | | 89 | 40-130 |
| 13C6-PFDA | | 86 | 40-130 |
| 13C7-PFUnA | | 76 | 30-130 |
| 13C8-PFOA | | 76 | 40-130 |
| 13C8-PFOS | | 84 | 40-130 |
| 13C8-PFOSA | | 81 | 40-130 |
| 13C9-PFNA | | 84 | 40-130 |
| D3-NMeFOSA | | 59 | 10-130 |
| D3-NMeFOSAA | | 80 | 40-170 |
| D5-NEtFOSA | | 61 | 10-130 |
| D5-NEtFOSAA | | 81 | 25-135 |
| D7-NMeFOSE | | 74 | 10-130 |
| D9-NEtFOSE | | 73 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16001-001
Batch: 16001
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/12/2024 1621

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 08/17/2024 1401 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 08/17/2024 1401 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 08/17/2024 1401 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 08/17/2024 1401 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 08/17/2024 1401 |
| 6:2FTS | 2.3 | JM-03 | 1 | 5.0 | 4.6 | 2.0 | ng/L | 08/17/2024 1401 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 08/17/2024 1401 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 08/17/2024 1401 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 08/17/2024 1401 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/17/2024 1401 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 08/17/2024 1401 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 08/17/2024 1401 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/17/2024 1401 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 08/17/2024 1401 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 08/17/2024 1401 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 08/17/2024 1401 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 08/17/2024 1401 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 08/17/2024 1401 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 08/17/2024 1401 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 08/17/2024 1401 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 08/17/2024 1401 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/17/2024 1401 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 08/17/2024 1401 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 08/17/2024 1401 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 08/17/2024 1401 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/17/2024 1401 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 08/17/2024 1401 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 08/17/2024 1401 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/17/2024 1401 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 08/17/2024 1401 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 08/17/2024 1401 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 08/17/2024 1401 |
| PFOS | 0.34 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 08/17/2024 1401 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/17/2024 1401 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 08/17/2024 1401 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 08/17/2024 1401 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 08/17/2024 1401 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 08/17/2024 1401 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 08/17/2024 1401 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 08/17/2024 1401 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 80 | 40-200 |
| 13C2-6:2FTS | | 81 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16001-001
Batch: 16001
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/12/2024 1621

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 76 | 40-300 |
| 13C2-PFDoA | | 82 | 10-130 |
| 13C2-PFTeDA | | 74 | 10-130 |
| 13C3-HFPO-DA | | 87 | 40-130 |
| 13C3-PFBS | | 80 | 40-135 |
| 13C3-PFHxS | | 85 | 40-130 |
| 13C4-PFBA | | 84 | 5-130 |
| 13C4-PFHpA | | 87 | 40-130 |
| 13C5-PFHxA | | 88 | 40-130 |
| 13C5-PFPeA | | 90 | 40-130 |
| 13C6-PFDA | | 84 | 40-130 |
| 13C7-PFUnA | | 82 | 30-130 |
| 13C8-PFOA | | 79 | 40-130 |
| 13C8-PFOS | | 81 | 40-130 |
| 13C8-PFOSA | | 77 | 40-130 |
| 13C9-PFNA | | 88 | 40-130 |
| D3-NMeFOSA | | 48 | 10-130 |
| D3-NMeFOSAA | | 85 | 40-170 |
| D5-NEtFOSA | | 49 | 10-130 |
| D5-NEtFOSAA | | 74 | 25-135 |
| D7-NMeFOSE | | 71 | 10-130 |
| D9-NEtFOSE | | 68 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16001-002
Batch: 16001
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/12/2024 1621

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 78 | | 1 | 86 | 55-160 | 08/17/2024 1411 |
| 9Cl-PF3ONS | 90 | 81 | | 1 | 90 | 70-155 | 08/17/2024 1411 |
| ADONA | 91 | 86 | | 1 | 94 | 65-145 | 08/17/2024 1411 |
| 8:2FTS | 92 | 91 | | 1 | 99 | 60-150 | 08/17/2024 1411 |
| 4:2FTS | 90 | 89 | | 1 | 99 | 70-145 | 08/17/2024 1411 |
| 6:2FTS | 91 | 90 | | 1 | 99 | 65-155 | 08/17/2024 1411 |
| 5:3FTCA | 600 | 590 | | 1 | 98 | 70-135 | 08/17/2024 1411 |
| HFPO-DA | 96 | 87 | | 1 | 90 | 70-140 | 08/17/2024 1411 |
| NEtFOSA | 24 | 25 | | 1 | 102 | 65-145 | 08/17/2024 1411 |
| NEtFOSAA | 24 | 24 | M-03 | 1 | 100 | 70-145 | 08/17/2024 1411 |
| NEtFOSE | 240 | 240 | | 1 | 98 | 70-135 | 08/17/2024 1411 |
| NMeFOSA | 24 | 24 | | 1 | 100 | 60-150 | 08/17/2024 1411 |
| NMeFOSAA | 24 | 23 | M-03 | 1 | 98 | 50-140 | 08/17/2024 1411 |
| NMeFOSE | 240 | 230 | | 1 | 96 | 70-145 | 08/17/2024 1411 |
| NFDHA | 48 | 49 | | 1 | 102 | 50-150 | 08/17/2024 1411 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 43 | | 1 | 101 | 70-140 | 08/17/2024 1411 |
| PFMPA | 48 | 55 | M-03 | 1 | 114 | 55-140 | 08/17/2024 1411 |
| PFMBA | 48 | 49 | M-03 | 1 | 102 | 60-150 | 08/17/2024 1411 |
| PFBS | 21 | 19 | | 1 | 91 | 60-145 | 08/17/2024 1411 |
| PFBA | 96 | 93 | | 1 | 97 | 70-140 | 08/17/2024 1411 |
| PFDS | 23 | 22 | M-03 | 1 | 96 | 60-145 | 08/17/2024 1411 |
| PFDA | 24 | 21 | | 1 | 89 | 70-140 | 08/17/2024 1411 |
| PFDoS | 23 | 19 | | 1 | 84 | 50-145 | 08/17/2024 1411 |
| PFDoA | 24 | 23 | | 1 | 96 | 70-140 | 08/17/2024 1411 |
| PFHpS | 23 | 22 | M-03 | 1 | 96 | 70-150 | 08/17/2024 1411 |
| PFHpA | 24 | 23 | | 1 | 94 | 70-150 | 08/17/2024 1411 |
| 7:3FTCA | 600 | 540 | | 1 | 89 | 50-145 | 08/17/2024 1411 |
| PFHxS | 22 | 22 | M-03 | 1 | 102 | 65-145 | 08/17/2024 1411 |
| PFHxA | 24 | 23 | | 1 | 97 | 70-145 | 08/17/2024 1411 |
| PFNS | 23 | 23 | | 1 | 98 | 65-145 | 08/17/2024 1411 |
| PFNA | 24 | 25 | | 1 | 104 | 70-150 | 08/17/2024 1411 |
| PFOSA | 24 | 24 | M-03 | 1 | 102 | 70-145 | 08/17/2024 1411 |
| PFOS | 22 | 21 | M-03 | 1 | 96 | 55-150 | 08/17/2024 1411 |
| PFOA | 24 | 22 | | 1 | 92 | 70-150 | 08/17/2024 1411 |
| PFPeS | 23 | 22 | | 1 | 98 | 65-140 | 08/17/2024 1411 |
| PFPeA | 48 | 48 | M-03 | 1 | 101 | 65-135 | 08/17/2024 1411 |
| 3:3FTCA | 120 | 120 | | 1 | 101 | 65-130 | 08/17/2024 1411 |
| PFTeDA | 24 | 25 | | 1 | 103 | 60-140 | 08/17/2024 1411 |
| PFTrDA | 24 | 26 | | 1 | 109 | 65-140 | 08/17/2024 1411 |
| PFUnA | 24 | 25 | | 1 | 105 | 70-145 | 08/17/2024 1411 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 78 | 40-200 |
| 13C2-6:2FTS | M-03 | 82 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16001-002
Batch: 16001
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/12/2024 1621

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 74 | 40-300 |
| 13C2-PFDoA | | 75 | 10-130 |
| 13C2-PFTeDA | | 63 | 10-130 |
| 13C3-HFPO-DA | | 78 | 40-130 |
| 13C3-PFBS | | 81 | 40-135 |
| 13C3-PFHxS | | 78 | 40-130 |
| 13C4-PFBA | | 76 | 5-130 |
| 13C4-PFHpA | | 74 | 40-130 |
| 13C5-PFHxA | | 74 | 40-130 |
| 13C5-PFPeA | | 77 | 40-130 |
| 13C6-PFDA | | 81 | 40-130 |
| 13C7-PFUnA | | 78 | 30-130 |
| 13C8-PFOA | | 69 | 40-130 |
| 13C8-PFOS | | 75 | 40-130 |
| 13C8-PFOSA | | 70 | 40-130 |
| 13C9-PFNA | | 70 | 40-130 |
| D3-NMeFOSA | | 45 | 10-130 |
| D3-NMeFOSAA | | 76 | 40-170 |
| D5-NEtFOSA | | 44 | 10-130 |
| D5-NEtFOSAA | | 69 | 25-135 |
| D7-NMeFOSE | | 66 | 10-130 |
| D9-NEtFOSE | | 63 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16001-102
Batch: 16001
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/12/2024 1621

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.4 | | 1 | 98 | 55-160 | 08/17/2024 1420 |
| 9Cl-PF3ONS | 7.5 | 7.8 | | 1 | 105 | 70-155 | 08/17/2024 1420 |
| ADONA | 7.6 | 8.2 | | 1 | 108 | 65-145 | 08/17/2024 1420 |
| 8:2FTS | 7.7 | 8.1 | | 1 | 106 | 60-150 | 08/17/2024 1420 |
| 4:2FTS | 7.5 | 7.7 | | 1 | 102 | 70-145 | 08/17/2024 1420 |
| 6:2FTS | 7.6 | 9.4 | | 1 | 124 | 65-155 | 08/17/2024 1420 |
| 5:3FTCA | 50 | 52 | M-03 | 1 | 104 | 70-135 | 08/17/2024 1420 |
| HFPO-DA | 8.0 | 9.3 | M-03 | 1 | 116 | 70-140 | 08/17/2024 1420 |
| NEtFOSA | 2.0 | 2.0 | M-03 | 1 | 98 | 65-145 | 08/17/2024 1420 |
| NEtFOSAA | 2.0 | 2.0 | M-03 | 1 | 98 | 70-145 | 08/17/2024 1420 |
| NEtFOSE | 20 | 21 | | 1 | 104 | 70-135 | 08/17/2024 1420 |
| NMeFOSA | 2.0 | 1.9 | | 1 | 96 | 60-150 | 08/17/2024 1420 |
| NMeFOSAA | 2.0 | 1.8 | M-03 | 1 | 92 | 50-140 | 08/17/2024 1420 |
| NMeFOSE | 20 | 20 | | 1 | 99 | 70-145 | 08/17/2024 1420 |
| NFDHA | 4.0 | 4.1 | | 1 | 104 | 50-150 | 08/17/2024 1420 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.7 | | 1 | 104 | 70-140 | 08/17/2024 1420 |
| PFMPA | 4.0 | 4.9 | M-03 | 1 | 121 | 55-140 | 08/17/2024 1420 |
| PFMBA | 4.0 | 4.0 | | 1 | 99 | 60-150 | 08/17/2024 1420 |
| PFBS | 1.8 | 1.7 | M-03 | 1 | 94 | 60-145 | 08/17/2024 1420 |
| PFBA | 8.0 | 7.9 | | 1 | 99 | 70-140 | 08/17/2024 1420 |
| PFDS | 1.9 | 1.8 | | 1 | 96 | 60-145 | 08/17/2024 1420 |
| PFDA | 2.0 | 2.1 | M-03 | 1 | 103 | 70-140 | 08/17/2024 1420 |
| PFDoS | 1.9 | 1.6 | M-03 | 1 | 84 | 50-145 | 08/17/2024 1420 |
| PFDoA | 2.0 | 1.9 | | 1 | 96 | 70-140 | 08/17/2024 1420 |
| PFHpS | 1.9 | 1.9 | | 1 | 102 | 70-150 | 08/17/2024 1420 |
| PFHpA | 2.0 | 2.1 | M-03 | 1 | 106 | 70-150 | 08/17/2024 1420 |
| 7:3FTCA | 50 | 48 | M-03 | 1 | 95 | 50-145 | 08/17/2024 1420 |
| PFHxS | 1.8 | 1.9 | M-03 | 1 | 106 | 65-145 | 08/17/2024 1420 |
| PFHxA | 2.0 | 1.9 | M-03 | 1 | 96 | 70-145 | 08/17/2024 1420 |
| PFNS | 1.9 | 1.9 | | 1 | 100 | 65-145 | 08/17/2024 1420 |
| PFNA | 2.0 | 2.2 | M-03 | 1 | 112 | 70-150 | 08/17/2024 1420 |
| PFOSA | 2.0 | 2.1 | M-03 | 1 | 104 | 70-145 | 08/17/2024 1420 |
| PFOS | 1.9 | 1.9 | M-03 | 1 | 100 | 55-150 | 08/17/2024 1420 |
| PFOA | 2.0 | 2.2 | M-03 | 1 | 111 | 70-150 | 08/17/2024 1420 |
| PFPeS | 1.9 | 1.9 | M-03 | 1 | 103 | 65-140 | 08/17/2024 1420 |
| PFPeA | 4.0 | 4.3 | M-03 | 1 | 108 | 65-135 | 08/17/2024 1420 |
| 3:3FTCA | 10 | 13 | NM-03 | 1 | 131 | 65-130 | 08/17/2024 1420 |
| PFTeDA | 2.0 | 2.1 | | 1 | 107 | 60-140 | 08/17/2024 1420 |
| PFTrDA | 2.0 | 2.2 | M-03 | 1 | 110 | 65-140 | 08/17/2024 1420 |
| PFUnA | 2.0 | 2.3 | M-03 | 1 | 113 | 70-145 | 08/17/2024 1420 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 73 | 40-200 |
| 13C2-6:2FTS | | 70 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16001-102
Batch: 16001
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/12/2024 1621

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 66 | 40-300 |
| 13C2-PFDoA | | 72 | 10-130 |
| 13C2-PFTeDA | | 62 | 10-130 |
| 13C3-HFPO-DA | | 75 | 40-130 |
| 13C3-PFBS | | 75 | 40-135 |
| 13C3-PFHxS | | 73 | 40-130 |
| 13C4-PFBA | | 75 | 5-130 |
| 13C4-PFHpA | | 78 | 40-130 |
| 13C5-PFHxA | | 76 | 40-130 |
| 13C5-PFPeA | | 76 | 40-130 |
| 13C6-PFDA | | 78 | 40-130 |
| 13C7-PFUnA | | 76 | 30-130 |
| 13C8-PFOA | | 68 | 40-130 |
| 13C8-PFOS | | 65 | 40-130 |
| 13C8-PFOSA | | 62 | 40-130 |
| 13C9-PFNA | | 71 | 40-130 |
| D3-NMeFOSA | | 44 | 10-130 |
| D3-NMeFOSAA | | 66 | 40-170 |
| D5-NEtFOSA | | 43 | 10-130 |
| D5-NEtFOSAA | | 60 | 25-135 |
| D7-NMeFOSE | | 56 | 10-130 |
| D9-NEtFOSE | | 52 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16118-001
Batch: 16118
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/13/2024 1925

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 08/15/2024 1036 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 08/15/2024 1036 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 08/15/2024 1036 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 08/15/2024 1036 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 08/15/2024 1036 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 08/15/2024 1036 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 08/15/2024 1036 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 08/15/2024 1036 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 08/15/2024 1036 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/15/2024 1036 |
| NEtFOSE | 2.0 | UM-03 | 1 | 10 | 2.0 | 0.61 | ng/L | 08/15/2024 1036 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 08/15/2024 1036 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/15/2024 1036 |
| NMeFOSE | 2.0 | UM-03 | 1 | 10 | 2.0 | 0.63 | ng/L | 08/15/2024 1036 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 08/15/2024 1036 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 08/15/2024 1036 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 08/15/2024 1036 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 08/15/2024 1036 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 08/15/2024 1036 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 08/15/2024 1036 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 08/15/2024 1036 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/15/2024 1036 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 08/15/2024 1036 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 08/15/2024 1036 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 08/15/2024 1036 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/15/2024 1036 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 08/15/2024 1036 |
| PFHxS | 0.73 | UM-03 | 1 | 1.0 | 0.73 | 0.18 | ng/L | 08/15/2024 1036 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/15/2024 1036 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 08/15/2024 1036 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 08/15/2024 1036 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 08/15/2024 1036 |
| PFOS | 0.28 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 08/15/2024 1036 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/15/2024 1036 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 08/15/2024 1036 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 08/15/2024 1036 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 08/15/2024 1036 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 08/15/2024 1036 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 08/15/2024 1036 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 08/15/2024 1036 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 83 | 40-200 |
| 13C2-6:2FTS | | 83 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16118-001
Batch: 16118
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/13/2024 1925

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 76 | 40-300 |
| 13C2-PFDoA | | 77 | 10-130 |
| 13C2-PFTeDA | | 71 | 10-130 |
| 13C3-HFPO-DA | | 89 | 40-130 |
| 13C3-PFBS | | 84 | 40-135 |
| 13C3-PFHxS | | 82 | 40-130 |
| 13C4-PFBA | | 83 | 5-130 |
| 13C4-PFHpA | | 85 | 40-130 |
| 13C5-PFHxA | | 83 | 40-130 |
| 13C5-PFPeA | | 84 | 40-130 |
| 13C6-PFDA | | 73 | 40-130 |
| 13C7-PFUnA | | 81 | 30-130 |
| 13C8-PFOA | | 76 | 40-130 |
| 13C8-PFOS | | 78 | 40-130 |
| 13C8-PFOSA | | 80 | 40-130 |
| 13C9-PFNA | | 80 | 40-130 |
| D3-NMeFOSA | | 60 | 10-130 |
| D3-NMeFOSAA | | 79 | 40-170 |
| D5-NEtFOSA | | 60 | 10-130 |
| D5-NEtFOSAA | | 78 | 25-135 |
| D7-NMeFOSE | | 80 | 10-130 |
| D9-NEtFOSE | | 75 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16118-002
Batch: 16118
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/13/2024 1925

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 93 | | 1 | 103 | 55-160 | 08/15/2024 1045 |
| 9Cl-PF3ONS | 90 | 94 | | 1 | 105 | 70-155 | 08/15/2024 1045 |
| ADONA | 91 | 100 | | 1 | 111 | 65-145 | 08/15/2024 1045 |
| 8:2FTS | 92 | 96 | | 1 | 104 | 60-150 | 08/15/2024 1045 |
| 4:2FTS | 90 | 100 | | 1 | 116 | 70-145 | 08/15/2024 1045 |
| 6:2FTS | 91 | 110 | | 1 | 120 | 65-155 | 08/15/2024 1045 |
| 5:3FTCA | 600 | 570 | | 1 | 95 | 70-135 | 08/15/2024 1045 |
| HFPO-DA | 96 | 100 | | 1 | 104 | 70-140 | 08/15/2024 1045 |
| NEtFOSA | 24 | 26 | | 1 | 107 | 65-145 | 08/15/2024 1045 |
| NEtFOSAA | 24 | 28 | M-03 | 1 | 117 | 70-145 | 08/15/2024 1045 |
| NEtFOSE | 240 | 270 | | 1 | 112 | 70-135 | 08/15/2024 1045 |
| NMeFOSA | 24 | 25 | | 1 | 106 | 60-150 | 08/15/2024 1045 |
| NMeFOSAA | 24 | 26 | M-03 | 1 | 108 | 50-140 | 08/15/2024 1045 |
| NMeFOSE | 240 | 260 | | 1 | 109 | 70-145 | 08/15/2024 1045 |
| NFDHA | 48 | 56 | | 1 | 117 | 50-150 | 08/15/2024 1045 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 52 | | 1 | 121 | 70-140 | 08/15/2024 1045 |
| PFMPA | 48 | 59 | | 1 | 123 | 55-140 | 08/15/2024 1045 |
| PFMBA | 48 | 60 | | 1 | 125 | 60-150 | 08/15/2024 1045 |
| PFBS | 21 | 23 | | 1 | 108 | 60-145 | 08/15/2024 1045 |
| PFBA | 96 | 110 | M-03 | 1 | 116 | 70-140 | 08/15/2024 1045 |
| PFDS | 23 | 25 | | 1 | 109 | 60-145 | 08/15/2024 1045 |
| PFDA | 24 | 25 | | 1 | 105 | 70-140 | 08/15/2024 1045 |
| PFDoS | 23 | 23 | | 1 | 99 | 50-145 | 08/15/2024 1045 |
| PFDoA | 24 | 25 | | 1 | 106 | 70-140 | 08/15/2024 1045 |
| PFHpS | 23 | 26 | | 1 | 112 | 70-150 | 08/15/2024 1045 |
| PFHpA | 24 | 25 | | 1 | 104 | 70-150 | 08/15/2024 1045 |
| 7:3FTCA | 600 | 490 | | 1 | 82 | 50-145 | 08/15/2024 1045 |
| PFHxS | 22 | 27 | M-03 | 1 | 121 | 65-145 | 08/15/2024 1045 |
| PFHxA | 24 | 24 | | 1 | 102 | 70-145 | 08/15/2024 1045 |
| PFNS | 23 | 25 | | 1 | 109 | 65-145 | 08/15/2024 1045 |
| PFNA | 24 | 26 | | 1 | 109 | 70-150 | 08/15/2024 1045 |
| PFOSA | 24 | 25 | | 1 | 106 | 70-145 | 08/15/2024 1045 |
| PFOS | 22 | 24 | M-03 | 1 | 107 | 55-150 | 08/15/2024 1045 |
| PFOA | 24 | 25 | | 1 | 105 | 70-150 | 08/15/2024 1045 |
| PFPeS | 23 | 26 | | 1 | 114 | 65-140 | 08/15/2024 1045 |
| PFPeA | 48 | 52 | | 1 | 108 | 65-135 | 08/15/2024 1045 |
| 3:3FTCA | 120 | 140 | | 1 | 113 | 65-130 | 08/15/2024 1045 |
| PFTeDA | 24 | 26 | | 1 | 110 | 60-140 | 08/15/2024 1045 |
| PFTrDA | 24 | 24 | | 1 | 99 | 65-140 | 08/15/2024 1045 |
| PFUnA | 24 | 27 | | 1 | 114 | 70-145 | 08/15/2024 1045 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 81 | 40-200 |
| 13C2-6:2FTS | | 82 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16118-002
Batch: 16118
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/13/2024 1925

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 80 | 40-300 |
| 13C2-PFDoA | | 77 | 10-130 |
| 13C2-PFTeDA | | 67 | 10-130 |
| 13C3-HFPO-DA | | 82 | 40-130 |
| 13C3-PFBS | | 81 | 40-135 |
| 13C3-PFHxS | | 80 | 40-130 |
| 13C4-PFBA | | 82 | 5-130 |
| 13C4-PFHpA | | 81 | 40-130 |
| 13C5-PFHxA | | 81 | 40-130 |
| 13C5-PFPeA | | 79 | 40-130 |
| 13C6-PFDA | | 80 | 40-130 |
| 13C7-PFUnA | | 76 | 30-130 |
| 13C8-PFOA | | 83 | 40-130 |
| 13C8-PFOS | | 73 | 40-130 |
| 13C8-PFOSA | | 72 | 40-130 |
| 13C9-PFNA | | 83 | 40-130 |
| D3-NMeFOSA | | 51 | 10-130 |
| D3-NMeFOSAA | | 75 | 40-170 |
| D5-NEtFOSA | | 51 | 10-130 |
| D5-NEtFOSAA | | 67 | 25-135 |
| D7-NMeFOSE | | 69 | 10-130 |
| D9-NEtFOSE | | 68 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16118-102
Batch: 16118
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/13/2024 1925

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 8.5 | | 1 | 112 | 55-160 | 08/15/2024 1055 |
| 9Cl-PF3ONS | 7.5 | 8.9 | | 1 | 119 | 70-155 | 08/15/2024 1055 |
| ADONA | 7.6 | 8.0 | | 1 | 106 | 65-145 | 08/15/2024 1055 |
| 8:2FTS | 7.7 | 7.9 | M-03 | 1 | 103 | 60-150 | 08/15/2024 1055 |
| 4:2FTS | 7.5 | 8.9 | M-03 | 1 | 119 | 70-145 | 08/15/2024 1055 |
| 6:2FTS | 7.6 | 8.0 | M-03 | 1 | 106 | 65-155 | 08/15/2024 1055 |
| 5:3FTCA | 50 | 45 | M-03 | 1 | 89 | 70-135 | 08/15/2024 1055 |
| HFPO-DA | 8.0 | 11 | M-03 | 1 | 139 | 70-140 | 08/15/2024 1055 |
| NEtFOSA | 2.0 | 2.2 | | 1 | 109 | 65-145 | 08/15/2024 1055 |
| NEtFOSAA | 2.0 | 2.2 | M-03 | 1 | 108 | 70-145 | 08/15/2024 1055 |
| NEtFOSE | 20 | 23 | | 1 | 116 | 70-135 | 08/15/2024 1055 |
| NMeFOSA | 2.0 | 2.4 | M-03 | 1 | 119 | 60-150 | 08/15/2024 1055 |
| NMeFOSAA | 2.0 | 2.6 | M-03 | 1 | 132 | 50-140 | 08/15/2024 1055 |
| NMeFOSE | 20 | 22 | | 1 | 112 | 70-145 | 08/15/2024 1055 |
| NFDHA | 4.0 | 4.6 | M-03 | 1 | 115 | 50-150 | 08/15/2024 1055 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.3 | M-03 | 1 | 122 | 70-140 | 08/15/2024 1055 |
| PFMPA | 4.0 | 5.1 | M-03 | 1 | 129 | 55-140 | 08/15/2024 1055 |
| PFMBA | 4.0 | 4.6 | M-03 | 1 | 116 | 60-150 | 08/15/2024 1055 |
| PFBS | 1.8 | 1.9 | M-03 | 1 | 110 | 60-145 | 08/15/2024 1055 |
| PFBA | 8.0 | 9.5 | M-03 | 1 | 119 | 70-140 | 08/15/2024 1055 |
| PFDS | 1.9 | 2.2 | | 1 | 114 | 60-145 | 08/15/2024 1055 |
| PFDA | 2.0 | 2.1 | M-03 | 1 | 105 | 70-140 | 08/15/2024 1055 |
| PFDoS | 1.9 | 1.9 | | 1 | 98 | 50-145 | 08/15/2024 1055 |
| PFDoA | 2.0 | 2.4 | | 1 | 120 | 70-140 | 08/15/2024 1055 |
| PFHpS | 1.9 | 2.3 | M-03 | 1 | 119 | 70-150 | 08/15/2024 1055 |
| PFHpA | 2.0 | 2.4 | M-03 | 1 | 118 | 70-150 | 08/15/2024 1055 |
| 7:3FTCA | 50 | 45 | | 1 | 90 | 50-145 | 08/15/2024 1055 |
| PFHxS | 1.8 | 2.1 | M-03 | 1 | 113 | 65-145 | 08/15/2024 1055 |
| PFHxA | 2.0 | 2.2 | M-03 | 1 | 111 | 70-145 | 08/15/2024 1055 |
| PFNS | 1.9 | 2.2 | | 1 | 114 | 65-145 | 08/15/2024 1055 |
| PFNA | 2.0 | 2.2 | M-03 | 1 | 109 | 70-150 | 08/15/2024 1055 |
| PFOSA | 2.0 | 2.2 | | 1 | 109 | 70-145 | 08/15/2024 1055 |
| PFOS | 1.9 | 2.0 | M-03 | 1 | 108 | 55-150 | 08/15/2024 1055 |
| PFOA | 2.0 | 2.4 | M-03 | 1 | 120 | 70-150 | 08/15/2024 1055 |
| PFPeS | 1.9 | 2.4 | M-03 | 1 | 126 | 65-140 | 08/15/2024 1055 |
| PFPeA | 4.0 | 4.8 | | 1 | 119 | 65-135 | 08/15/2024 1055 |
| 3:3FTCA | 10 | 11 | M-03 | 1 | 114 | 65-130 | 08/15/2024 1055 |
| PFTeDA | 2.0 | 2.4 | M-03 | 1 | 119 | 60-140 | 08/15/2024 1055 |
| PFTrDA | 2.0 | 2.2 | M-03 | 1 | 111 | 65-140 | 08/15/2024 1055 |
| PFUnA | 2.0 | 2.7 | | 1 | 134 | 70-145 | 08/15/2024 1055 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 86 | 40-200 |
| 13C2-6:2FTS | | 91 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16118-102
Batch: 16118
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/13/2024 1925

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 81 | 40-300 |
| 13C2-PFDoA | | 84 | 10-130 |
| 13C2-PFTeDA | | 76 | 10-130 |
| 13C3-HFPO-DA | | 84 | 40-130 |
| 13C3-PFBS | | 81 | 40-135 |
| 13C3-PFHxS | | 80 | 40-130 |
| 13C4-PFBA | | 82 | 5-130 |
| 13C4-PFHpA | | 79 | 40-130 |
| 13C5-PFHxA | | 81 | 40-130 |
| 13C5-PFPeA | | 81 | 40-130 |
| 13C6-PFDA | | 87 | 40-130 |
| 13C7-PFUnA | | 84 | 30-130 |
| 13C8-PFOA | | 81 | 40-130 |
| 13C8-PFOS | | 77 | 40-130 |
| 13C8-PFOSA | | 75 | 40-130 |
| 13C9-PFNA | | 79 | 40-130 |
| D3-NMeFOSA | | 48 | 10-130 |
| D3-NMeFOSAA | | 75 | 40-170 |
| D5-NEtFOSA | | 51 | 10-130 |
| D5-NEtFOSAA | | 74 | 25-135 |
| D7-NMeFOSE | | 69 | 10-130 |
| D9-NEtFOSE | | 69 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16172-001
Batch: 16172
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/14/2024 1924

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 08/20/2024 0531 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 08/20/2024 0531 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 08/20/2024 0531 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 08/20/2024 0531 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 08/20/2024 0531 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 08/20/2024 0531 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 08/20/2024 0531 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 08/20/2024 0531 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 08/20/2024 0531 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/20/2024 0531 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 08/20/2024 0531 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 08/20/2024 0531 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/20/2024 0531 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 08/20/2024 0531 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 08/20/2024 0531 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 08/20/2024 0531 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 08/20/2024 0531 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 08/20/2024 0531 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 08/20/2024 0531 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 08/20/2024 0531 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 08/20/2024 0531 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/20/2024 0531 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 08/20/2024 0531 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 08/20/2024 0531 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 08/20/2024 0531 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/20/2024 0531 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 08/20/2024 0531 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 08/20/2024 0531 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/20/2024 0531 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 08/20/2024 0531 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 08/20/2024 0531 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 08/20/2024 0531 |
| PFOS | 0.36 | JM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 08/20/2024 0531 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/20/2024 0531 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 08/20/2024 0531 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 08/20/2024 0531 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 08/20/2024 0531 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 08/20/2024 0531 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 08/20/2024 0531 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 08/20/2024 0531 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 92 | 40-200 |
| 13C2-6:2FTS | | 100 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16172-001
Batch: 16172
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/14/2024 1924

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 90 | 40-300 |
| 13C2-PFDoA | | 75 | 10-130 |
| 13C2-PFTeDA | | 71 | 10-130 |
| 13C3-HFPO-DA | | 84 | 40-130 |
| 13C3-PFBS | | 94 | 40-135 |
| 13C3-PFHxS | | 98 | 40-130 |
| 13C4-PFBA | | 84 | 5-130 |
| 13C4-PFHpA | | 85 | 40-130 |
| 13C5-PFHxA | | 83 | 40-130 |
| 13C5-PFPeA | | 83 | 40-130 |
| 13C6-PFDA | | 85 | 40-130 |
| 13C7-PFUnA | | 81 | 30-130 |
| 13C8-PFOA | | 74 | 40-130 |
| 13C8-PFOS | | 81 | 40-130 |
| 13C8-PFOSA | | 82 | 40-130 |
| 13C9-PFNA | | 72 | 40-130 |
| D3-NMeFOSA | | 66 | 10-130 |
| D3-NMeFOSAA | | 81 | 40-170 |
| D5-NEtFOSA | | 70 | 10-130 |
| D5-NEtFOSAA | | 77 | 25-135 |
| D7-NMeFOSE | | 82 | 10-130 |
| D9-NEtFOSE | | 80 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16172-002
Batch: 16172
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/14/2024 1924

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 90 | | 1 | 100 | 55-160 | 08/20/2024 0540 |
| 9Cl-PF3ONS | 90 | 87 | | 1 | 97 | 70-155 | 08/20/2024 0540 |
| ADONA | 91 | 90 | | 1 | 99 | 65-145 | 08/20/2024 0540 |
| 8:2FTS | 92 | 84 | | 1 | 91 | 60-150 | 08/20/2024 0540 |
| 4:2FTS | 90 | 94 | | 1 | 104 | 70-145 | 08/20/2024 0540 |
| 6:2FTS | 91 | 94 | | 1 | 104 | 65-155 | 08/20/2024 0540 |
| 5:3FTCA | 600 | 500 | | 1 | 83 | 70-135 | 08/20/2024 0540 |
| HFPO-DA | 96 | 87 | | 1 | 91 | 70-140 | 08/20/2024 0540 |
| NEtFOSA | 24 | 24 | | 1 | 98 | 65-145 | 08/20/2024 0540 |
| NEtFOSAA | 24 | 23 | M-03 | 1 | 95 | 70-145 | 08/20/2024 0540 |
| NEtFOSE | 240 | 250 | | 1 | 103 | 70-135 | 08/20/2024 0540 |
| NMeFOSA | 24 | 25 | | 1 | 105 | 60-150 | 08/20/2024 0540 |
| NMeFOSAA | 24 | 25 | M-03 | 1 | 105 | 50-140 | 08/20/2024 0540 |
| NMeFOSE | 240 | 250 | | 1 | 104 | 70-145 | 08/20/2024 0540 |
| NFDHA | 48 | 43 | | 1 | 89 | 50-150 | 08/20/2024 0540 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 38 | | 1 | 89 | 70-140 | 08/20/2024 0540 |
| PFMPA | 48 | 47 | | 1 | 97 | 55-140 | 08/20/2024 0540 |
| PFMBA | 48 | 41 | | 1 | 86 | 60-150 | 08/20/2024 0540 |
| PFBS | 21 | 21 | | 1 | 99 | 60-145 | 08/20/2024 0540 |
| PFBA | 96 | 97 | | 1 | 101 | 70-140 | 08/20/2024 0540 |
| PFDS | 23 | 23 | | 1 | 100 | 60-145 | 08/20/2024 0540 |
| PFDA | 24 | 22 | | 1 | 93 | 70-140 | 08/20/2024 0540 |
| PFDoS | 23 | 21 | | 1 | 91 | 50-145 | 08/20/2024 0540 |
| PFDoA | 24 | 24 | | 1 | 98 | 70-140 | 08/20/2024 0540 |
| PFHpS | 23 | 23 | | 1 | 99 | 70-150 | 08/20/2024 0540 |
| PFHpA | 24 | 25 | | 1 | 106 | 70-150 | 08/20/2024 0540 |
| 7:3FTCA | 600 | 480 | | 1 | 80 | 50-145 | 08/20/2024 0540 |
| PFHxS | 22 | 20 | | 1 | 93 | 65-145 | 08/20/2024 0540 |
| PFHxA | 24 | 24 | | 1 | 101 | 70-145 | 08/20/2024 0540 |
| PFNS | 23 | 25 | | 1 | 106 | 65-145 | 08/20/2024 0540 |
| PFNA | 24 | 27 | | 1 | 111 | 70-150 | 08/20/2024 0540 |
| PFOSA | 24 | 24 | | 1 | 99 | 70-145 | 08/20/2024 0540 |
| PFOS | 22 | 22 | M-03 | 1 | 97 | 55-150 | 08/20/2024 0540 |
| PFOA | 24 | 23 | | 1 | 97 | 70-150 | 08/20/2024 0540 |
| PFPeS | 23 | 23 | | 1 | 102 | 65-140 | 08/20/2024 0540 |
| PFPeA | 48 | 48 | | 1 | 99 | 65-135 | 08/20/2024 0540 |
| 3:3FTCA | 120 | 110 | | 1 | 95 | 65-130 | 08/20/2024 0540 |
| PFTeDA | 24 | 25 | | 1 | 105 | 60-140 | 08/20/2024 0540 |
| PFTrDA | 24 | 27 | | 1 | 114 | 65-140 | 08/20/2024 0540 |
| PFUnA | 24 | 24 | | 1 | 99 | 70-145 | 08/20/2024 0540 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 96 | 40-200 |
| 13C2-6:2FTS | | 100 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16172-002
Batch: 16172
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/14/2024 1924

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 99 | 40-300 |
| 13C2-PFDoA | | 82 | 10-130 |
| 13C2-PFTeDA | | 73 | 10-130 |
| 13C3-HFPO-DA | | 87 | 40-130 |
| 13C3-PFBS | | 99 | 40-135 |
| 13C3-PFHxS | | 102 | 40-130 |
| 13C4-PFBA | | 89 | 5-130 |
| 13C4-PFHpA | | 83 | 40-130 |
| 13C5-PFHxA | | 87 | 40-130 |
| 13C5-PFPeA | | 90 | 40-130 |
| 13C6-PFDA | | 89 | 40-130 |
| 13C7-PFUnA | | 90 | 30-130 |
| 13C8-PFOA | | 78 | 40-130 |
| 13C8-PFOS | | 79 | 40-130 |
| 13C8-PFOSA | | 81 | 40-130 |
| 13C9-PFNA | | 80 | 40-130 |
| D3-NMeFOSA | | 67 | 10-130 |
| D3-NMeFOSAA | | 90 | 40-170 |
| D5-NEtFOSA | | 70 | 10-130 |
| D5-NEtFOSAA | | 73 | 25-135 |
| D7-NMeFOSE | | 80 | 10-130 |
| D9-NEtFOSE | | 79 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16172-102
Batch: 16172
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/14/2024 1924

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 6.9 | | 1 | 91 | 55-160 | 08/21/2024 1618 |
| 9Cl-PF3ONS | 7.5 | 6.7 | | 1 | 89 | 70-155 | 08/21/2024 1618 |
| ADONA | 7.6 | 7.4 | | 1 | 98 | 65-145 | 08/21/2024 1618 |
| 8:2FTS | 7.7 | 6.6 | | 1 | 86 | 60-150 | 08/21/2024 1618 |
| 4:2FTS | 7.5 | 6.9 | | 1 | 92 | 70-145 | 08/21/2024 1618 |
| 6:2FTS | 7.6 | 7.3 | | 1 | 96 | 65-155 | 08/21/2024 1618 |
| 5:3FTCA | 50 | 37 | | 1 | 74 | 70-135 | 08/21/2024 1618 |
| HFPO-DA | 8.0 | 7.5 | | 1 | 93 | 70-140 | 08/21/2024 1618 |
| NEtFOSA | 2.0 | 1.7 | M-03 | 1 | 85 | 65-145 | 08/21/2024 1618 |
| NEtFOSAA | 2.0 | 1.9 | | 1 | 96 | 70-145 | 08/21/2024 1618 |
| NEtFOSE | 20 | 18 | | 1 | 92 | 70-135 | 08/21/2024 1618 |
| NMeFOSA | 2.0 | 1.8 | | 1 | 91 | 60-150 | 08/21/2024 1618 |
| NMeFOSAA | 2.0 | 1.5 | | 1 | 77 | 50-140 | 08/21/2024 1618 |
| NMeFOSE | 20 | 18 | | 1 | 92 | 70-145 | 08/21/2024 1618 |
| NFDHA | 4.0 | 3.9 | M-03 | 1 | 97 | 50-150 | 08/21/2024 1618 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.4 | | 1 | 97 | 70-140 | 08/21/2024 1618 |
| PFMPA | 4.0 | 4.1 | | 1 | 102 | 55-140 | 08/21/2024 1618 |
| PFMBA | 4.0 | 3.6 | | 1 | 89 | 60-150 | 08/21/2024 1618 |
| PFBS | 1.8 | 1.7 | | 1 | 99 | 60-145 | 08/21/2024 1618 |
| PFBA | 8.0 | 7.5 | | 1 | 93 | 70-140 | 08/21/2024 1618 |
| PFDS | 1.9 | 1.8 | | 1 | 95 | 60-145 | 08/21/2024 1618 |
| PFDA | 2.0 | 1.8 | M-03 | 1 | 90 | 70-140 | 08/21/2024 1618 |
| PFDoS | 1.9 | 1.8 | M-03 | 1 | 91 | 50-145 | 08/21/2024 1618 |
| PFDoA | 2.0 | 1.9 | M-03 | 1 | 94 | 70-140 | 08/21/2024 1618 |
| PFHpS | 1.9 | 1.9 | | 1 | 101 | 70-150 | 08/21/2024 1618 |
| PFHpA | 2.0 | 1.9 | | 1 | 95 | 70-150 | 08/21/2024 1618 |
| 7:3FTCA | 50 | 37 | | 1 | 73 | 50-145 | 08/21/2024 1618 |
| PFHxS | 1.8 | 1.8 | | 1 | 101 | 65-145 | 08/21/2024 1618 |
| PFHxA | 2.0 | 1.9 | M-03 | 1 | 96 | 70-145 | 08/21/2024 1618 |
| PFNS | 1.9 | 2.0 | | 1 | 103 | 65-145 | 08/21/2024 1618 |
| PFNA | 2.0 | 2.1 | | 1 | 105 | 70-150 | 08/21/2024 1618 |
| PFOSA | 2.0 | 2.0 | M-03 | 1 | 99 | 70-145 | 08/21/2024 1618 |
| PFOS | 1.9 | 2.4 | M-03 | 1 | 127 | 55-150 | 08/21/2024 1618 |
| PFOA | 2.0 | 1.8 | | 1 | 88 | 70-150 | 08/21/2024 1618 |
| PFPeS | 1.9 | 1.8 | M-03 | 1 | 94 | 65-140 | 08/21/2024 1618 |
| PFPeA | 4.0 | 3.7 | | 1 | 93 | 65-135 | 08/21/2024 1618 |
| 3:3FTCA | 10 | 10 | M-03 | 1 | 101 | 65-130 | 08/21/2024 1618 |
| PFTeDA | 2.0 | 2.0 | M-03 | 1 | 100 | 60-140 | 08/21/2024 1618 |
| PFTrDA | 2.0 | 1.7 | | 1 | 87 | 65-140 | 08/21/2024 1618 |
| PFUnA | 2.0 | 1.9 | M-03 | 1 | 95 | 70-145 | 08/21/2024 1618 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 97 | 40-200 |
| 13C2-6:2FTS | | 91 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16172-102
Batch: 16172
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/14/2024 1924

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 81 | 40-300 |
| 13C2-PFDoA | | 79 | 10-130 |
| 13C2-PFTeDA | | 64 | 10-130 |
| 13C3-HFPO-DA | | 86 | 40-130 |
| 13C3-PFBS | | 90 | 40-135 |
| 13C3-PFHxS | | 97 | 40-130 |
| 13C4-PFBA | | 88 | 5-130 |
| 13C4-PFHpA | | 81 | 40-130 |
| 13C5-PFHxA | | 88 | 40-130 |
| 13C5-PFPeA | | 86 | 40-130 |
| 13C6-PFDA | | 84 | 40-130 |
| 13C7-PFUnA | | 70 | 30-130 |
| 13C8-PFOA | | 79 | 40-130 |
| 13C8-PFOS | | 80 | 40-130 |
| 13C8-PFOSA | | 83 | 40-130 |
| 13C9-PFNA | | 81 | 40-130 |
| D3-NMeFOSA | | 68 | 10-130 |
| D3-NMeFOSAA | | 90 | 40-170 |
| D5-NEtFOSA | | 68 | 10-130 |
| D5-NEtFOSAA | | 82 | 25-135 |
| D7-NMeFOSE | | 81 | 10-130 |
| D9-NEtFOSE | | 78 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16352-001
Batch: 16352
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/16/2024 1008

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 08/22/2024 0522 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 08/22/2024 0522 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 08/22/2024 0522 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 08/22/2024 0522 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 08/22/2024 0522 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 08/22/2024 0522 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 08/22/2024 0522 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 08/22/2024 0522 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 08/22/2024 0522 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/22/2024 0522 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 08/22/2024 0522 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 08/22/2024 0522 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/22/2024 0522 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 08/22/2024 0522 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 08/22/2024 0522 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 08/22/2024 0522 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 08/22/2024 0522 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 08/22/2024 0522 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 08/22/2024 0522 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 08/22/2024 0522 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 08/22/2024 0522 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/22/2024 0522 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 08/22/2024 0522 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 08/22/2024 0522 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 08/22/2024 0522 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/22/2024 0522 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 08/22/2024 0522 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 08/22/2024 0522 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/22/2024 0522 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 08/22/2024 0522 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 08/22/2024 0522 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 08/22/2024 0522 |
| PFOS | 0.74 | UM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 08/22/2024 0522 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/22/2024 0522 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 08/22/2024 0522 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 08/22/2024 0522 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 08/22/2024 0522 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 08/22/2024 0522 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 08/22/2024 0522 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 08/22/2024 0522 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 75 | 40-200 |
| 13C2-6:2FTS | | 68 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16352-001
Batch: 16352
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/16/2024 1008

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 68 | 40-300 |
| 13C2-PFDoA | | 56 | 10-130 |
| 13C2-PFTeDA | | 55 | 10-130 |
| 13C3-HFPO-DA | | 77 | 40-130 |
| 13C3-PFBS | | 75 | 40-135 |
| 13C3-PFHxS | | 73 | 40-130 |
| 13C4-PFBA | | 76 | 5-130 |
| 13C4-PFHpA | | 74 | 40-130 |
| 13C5-PFHxA | | 75 | 40-130 |
| 13C5-PFPeA | | 76 | 40-130 |
| 13C6-PFDA | | 65 | 40-130 |
| 13C7-PFUnA | | 56 | 30-130 |
| 13C8-PFOA | | 74 | 40-130 |
| 13C8-PFOS | | 72 | 40-130 |
| 13C8-PFOSA | | 71 | 40-130 |
| 13C9-PFNA | | 74 | 40-130 |
| D3-NMeFOSA | | 45 | 10-130 |
| D3-NMeFOSAA | | 71 | 40-170 |
| D5-NEtFOSA | | 44 | 10-130 |
| D5-NEtFOSAA | | 68 | 25-135 |
| D7-NMeFOSE | | 60 | 10-130 |
| D9-NEtFOSE | | 60 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16352-002
Batch: 16352
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/16/2024 1008

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 90 | | 1 | 99 | 55-160 | 08/22/2024 0531 |
| 9Cl-PF3ONS | 90 | 99 | | 1 | 110 | 70-155 | 08/22/2024 0531 |
| ADONA | 91 | 100 | | 1 | 111 | 65-145 | 08/22/2024 0531 |
| 8:2FTS | 92 | 100 | | 1 | 110 | 60-150 | 08/22/2024 0531 |
| 4:2FTS | 90 | 100 | | 1 | 113 | 70-145 | 08/22/2024 0531 |
| 6:2FTS | 91 | 92 | | 1 | 101 | 65-155 | 08/22/2024 0531 |
| 5:3FTCA | 600 | 590 | | 1 | 98 | 70-135 | 08/22/2024 0531 |
| HFPO-DA | 96 | 96 | | 1 | 100 | 70-140 | 08/22/2024 0531 |
| NEtFOSA | 24 | 27 | | 1 | 111 | 65-145 | 08/22/2024 0531 |
| NEtFOSAA | 24 | 26 | M-03 | 1 | 109 | 70-145 | 08/22/2024 0531 |
| NEtFOSE | 240 | 270 | | 1 | 112 | 70-135 | 08/22/2024 0531 |
| NMeFOSA | 24 | 26 | | 1 | 109 | 60-150 | 08/22/2024 0531 |
| NMeFOSAA | 24 | 24 | M-03 | 1 | 100 | 50-140 | 08/22/2024 0531 |
| NMeFOSE | 240 | 270 | | 1 | 111 | 70-145 | 08/22/2024 0531 |
| NFDHA | 48 | 47 | | 1 | 98 | 50-150 | 08/22/2024 0531 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 42 | | 1 | 97 | 70-140 | 08/22/2024 0531 |
| PFMPA | 48 | 46 | | 1 | 95 | 55-140 | 08/22/2024 0531 |
| PFMBA | 48 | 43 | | 1 | 89 | 60-150 | 08/22/2024 0531 |
| PFBS | 21 | 22 | | 1 | 106 | 60-145 | 08/22/2024 0531 |
| PFBA | 96 | 100 | | 1 | 109 | 70-140 | 08/22/2024 0531 |
| PFDS | 23 | 26 | | 1 | 111 | 60-145 | 08/22/2024 0531 |
| PFDA | 24 | 25 | | 1 | 103 | 70-140 | 08/22/2024 0531 |
| PFDoS | 23 | 23 | | 1 | 97 | 50-145 | 08/22/2024 0531 |
| PFDoA | 24 | 26 | | 1 | 109 | 70-140 | 08/22/2024 0531 |
| PFHpS | 23 | 27 | | 1 | 117 | 70-150 | 08/22/2024 0531 |
| PFHpA | 24 | 26 | | 1 | 107 | 70-150 | 08/22/2024 0531 |
| 7:3FTCA | 600 | 540 | | 1 | 91 | 50-145 | 08/22/2024 0531 |
| PFHxS | 22 | 24 | | 1 | 109 | 65-145 | 08/22/2024 0531 |
| PFHxA | 24 | 28 | | 1 | 116 | 70-145 | 08/22/2024 0531 |
| PFNS | 23 | 26 | | 1 | 112 | 65-145 | 08/22/2024 0531 |
| PFNA | 24 | 25 | | 1 | 104 | 70-150 | 08/22/2024 0531 |
| PFOSA | 24 | 26 | | 1 | 108 | 70-145 | 08/22/2024 0531 |
| PFOS | 22 | 26 | M-03 | 1 | 117 | 55-150 | 08/22/2024 0531 |
| PFOA | 24 | 23 | | 1 | 98 | 70-150 | 08/22/2024 0531 |
| PFPeS | 23 | 27 | | 1 | 119 | 65-140 | 08/22/2024 0531 |
| PFPeA | 48 | 51 | | 1 | 107 | 65-135 | 08/22/2024 0531 |
| 3:3FTCA | 120 | 120 | | 1 | 97 | 65-130 | 08/22/2024 0531 |
| PFTeDA | 24 | 27 | | 1 | 113 | 60-140 | 08/22/2024 0531 |
| PFTrDA | 24 | 26 | | 1 | 108 | 65-140 | 08/22/2024 0531 |
| PFUnA | 24 | 26 | | 1 | 110 | 70-145 | 08/22/2024 0531 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 74 | 40-200 |
| 13C2-6:2FTS | | 77 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16352-002
Batch: 16352
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/16/2024 1008

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 66 | 40-300 |
| 13C2-PFDoA | | 63 | 10-130 |
| 13C2-PFTeDA | | 58 | 10-130 |
| 13C3-HFPO-DA | | 77 | 40-130 |
| 13C3-PFBS | | 78 | 40-135 |
| 13C3-PFHxS | | 74 | 40-130 |
| 13C4-PFBA | | 76 | 5-130 |
| 13C4-PFHpA | | 77 | 40-130 |
| 13C5-PFHxA | | 77 | 40-130 |
| 13C5-PFPeA | | 80 | 40-130 |
| 13C6-PFDA | | 75 | 40-130 |
| 13C7-PFUnA | | 66 | 30-130 |
| 13C8-PFOA | | 73 | 40-130 |
| 13C8-PFOS | | 70 | 40-130 |
| 13C8-PFOSA | | 71 | 40-130 |
| 13C9-PFNA | | 77 | 40-130 |
| D3-NMeFOSA | | 42 | 10-130 |
| D3-NMeFOSAA | | 76 | 40-170 |
| D5-NEtFOSA | | 42 | 10-130 |
| D5-NEtFOSAA | | 69 | 25-135 |
| D7-NMeFOSE | | 59 | 10-130 |
| D9-NEtFOSE | | 59 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16352-102
Batch: 16352
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/16/2024 1008

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 6.1 | | 1 | 80 | 55-160 | 08/22/2024 0541 |
| 9Cl-PF3ONS | 7.5 | 6.5 | | 1 | 87 | 70-155 | 08/22/2024 0541 |
| ADONA | 7.6 | 7.0 | | 1 | 93 | 65-145 | 08/22/2024 0541 |
| 8:2FTS | 7.7 | 7.8 | | 1 | 101 | 60-150 | 08/22/2024 0541 |
| 4:2FTS | 7.5 | 6.9 | | 1 | 92 | 70-145 | 08/22/2024 0541 |
| 6:2FTS | 7.6 | 7.4 | M-03 | 1 | 97 | 65-155 | 08/22/2024 0541 |
| 5:3FTCA | 50 | 48 | | 1 | 95 | 70-135 | 08/22/2024 0541 |
| HFPO-DA | 8.0 | 7.6 | M-03 | 1 | 95 | 70-140 | 08/22/2024 0541 |
| NEtFOSA | 2.0 | 1.8 | | 1 | 91 | 65-145 | 08/22/2024 0541 |
| NEtFOSAA | 2.0 | 2.1 | | 1 | 105 | 70-145 | 08/22/2024 0541 |
| NEtFOSE | 20 | 18 | | 1 | 92 | 70-135 | 08/22/2024 0541 |
| NMeFOSA | 2.0 | 1.8 | | 1 | 91 | 60-150 | 08/22/2024 0541 |
| NMeFOSAA | 2.0 | 1.7 | | 1 | 85 | 50-140 | 08/22/2024 0541 |
| NMeFOSE | 20 | 18 | | 1 | 90 | 70-145 | 08/22/2024 0541 |
| NFDHA | 4.0 | 3.7 | M-03 | 1 | 93 | 50-150 | 08/22/2024 0541 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.4 | | 1 | 95 | 70-140 | 08/22/2024 0541 |
| PFMPA | 4.0 | 3.5 | | 1 | 88 | 55-140 | 08/22/2024 0541 |
| PFMBA | 4.0 | 3.3 | | 1 | 83 | 60-150 | 08/22/2024 0541 |
| PFBS | 1.8 | 1.5 | | 1 | 86 | 60-145 | 08/22/2024 0541 |
| PFBA | 8.0 | 7.3 | | 1 | 91 | 70-140 | 08/22/2024 0541 |
| PFDS | 1.9 | 1.8 | | 1 | 93 | 60-145 | 08/22/2024 0541 |
| PFDA | 2.0 | 1.9 | M-03 | 1 | 97 | 70-140 | 08/22/2024 0541 |
| PFDoS | 1.9 | 1.5 | | 1 | 80 | 50-145 | 08/22/2024 0541 |
| PFDoA | 2.0 | 2.1 | M-03 | 1 | 103 | 70-140 | 08/22/2024 0541 |
| PFHpS | 1.9 | 1.9 | | 1 | 100 | 70-150 | 08/22/2024 0541 |
| PFHpA | 2.0 | 1.7 | | 1 | 85 | 70-150 | 08/22/2024 0541 |
| 7:3FTCA | 50 | 40 | | 1 | 80 | 50-145 | 08/22/2024 0541 |
| PFHxS | 1.8 | 1.6 | | 1 | 89 | 65-145 | 08/22/2024 0541 |
| PFHxA | 2.0 | 1.8 | | 1 | 92 | 70-145 | 08/22/2024 0541 |
| PFNS | 1.9 | 1.9 | | 1 | 96 | 65-145 | 08/22/2024 0541 |
| PFNA | 2.0 | 1.8 | M-03 | 1 | 88 | 70-150 | 08/22/2024 0541 |
| PFOSA | 2.0 | 1.8 | | 1 | 90 | 70-145 | 08/22/2024 0541 |
| PFOS | 1.9 | 1.7 | | 1 | 90 | 55-150 | 08/22/2024 0541 |
| PFOA | 2.0 | 1.8 | M-03 | 1 | 92 | 70-150 | 08/22/2024 0541 |
| PFPeS | 1.9 | 1.7 | | 1 | 89 | 65-140 | 08/22/2024 0541 |
| PFPeA | 4.0 | 3.7 | M-03 | 1 | 92 | 65-135 | 08/22/2024 0541 |
| 3:3FTCA | 10 | 8.8 | | 1 | 88 | 65-130 | 08/22/2024 0541 |
| PFTeDA | 2.0 | 1.9 | | 1 | 95 | 60-140 | 08/22/2024 0541 |
| PFTrDA | 2.0 | 1.9 | M-03 | 1 | 97 | 65-140 | 08/22/2024 0541 |
| PFUnA | 2.0 | 1.7 | | 1 | 87 | 70-145 | 08/22/2024 0541 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 75 | 40-200 |
| 13C2-6:2FTS | | 75 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16352-102
Batch: 16352
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/16/2024 1008

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 65 | 40-300 |
| 13C2-PFDoA | | 65 | 10-130 |
| 13C2-PFTeDA | | 61 | 10-130 |
| 13C3-HFPO-DA | | 79 | 40-130 |
| 13C3-PFBS | | 79 | 40-135 |
| 13C3-PFHxS | | 78 | 40-130 |
| 13C4-PFBA | | 79 | 5-130 |
| 13C4-PFHpA | | 80 | 40-130 |
| 13C5-PFHxA | | 76 | 40-130 |
| 13C5-PFPeA | | 80 | 40-130 |
| 13C6-PFDA | | 79 | 40-130 |
| 13C7-PFUnA | | 70 | 30-130 |
| 13C8-PFOA | | 77 | 40-130 |
| 13C8-PFOS | | 71 | 40-130 |
| 13C8-PFOSA | | 73 | 40-130 |
| 13C9-PFNA | | 85 | 40-130 |
| D3-NMeFOSA | | 44 | 10-130 |
| D3-NMeFOSAA | | 67 | 40-170 |
| D5-NEtFOSA | | 41 | 10-130 |
| D5-NEtFOSAA | | 65 | 25-135 |
| D7-NMeFOSE | | 57 | 10-130 |
| D9-NEtFOSE | | 55 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16518-001
Batch: 16518
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/20/2024 1708

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 08/24/2024 0851 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 08/24/2024 0851 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 08/24/2024 0851 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 08/24/2024 0851 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 08/24/2024 0851 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 08/24/2024 0851 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 08/24/2024 0851 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 08/24/2024 0851 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 08/24/2024 0851 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/24/2024 0851 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 08/24/2024 0851 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 08/24/2024 0851 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/24/2024 0851 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 08/24/2024 0851 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 08/24/2024 0851 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 08/24/2024 0851 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 08/24/2024 0851 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 08/24/2024 0851 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 08/24/2024 0851 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 08/24/2024 0851 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 08/24/2024 0851 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/24/2024 0851 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 08/24/2024 0851 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 08/24/2024 0851 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 08/24/2024 0851 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/24/2024 0851 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 08/24/2024 0851 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 08/24/2024 0851 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/24/2024 0851 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 08/24/2024 0851 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 08/24/2024 0851 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 08/24/2024 0851 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 08/24/2024 0851 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/24/2024 0851 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 08/24/2024 0851 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 08/24/2024 0851 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 08/24/2024 0851 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 08/24/2024 0851 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 08/24/2024 0851 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 08/24/2024 0851 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 90 | 40-200 |
| 13C2-6:2FTS | | 90 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16518-001
Batch: 16518
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/20/2024 1708

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 84 | 40-300 |
| 13C2-PFDoA | | 62 | 10-130 |
| 13C2-PFTeDA | | 65 | 10-130 |
| 13C3-HFPO-DA | | 82 | 40-130 |
| 13C3-PFBS | | 93 | 40-135 |
| 13C3-PFHxS | | 90 | 40-130 |
| 13C4-PFBA | | 88 | 5-130 |
| 13C4-PFHpA | | 87 | 40-130 |
| 13C5-PFHxA | | 87 | 40-130 |
| 13C5-PFPeA | | 88 | 40-130 |
| 13C6-PFDA | | 83 | 40-130 |
| 13C7-PFUnA | | 76 | 30-130 |
| 13C8-PFOA | | 86 | 40-130 |
| 13C8-PFOS | | 84 | 40-130 |
| 13C8-PFOSA | | 82 | 40-130 |
| 13C9-PFNA | | 85 | 40-130 |
| D3-NMeFOSA | | 44 | 10-130 |
| D3-NMeFOSAA | | 84 | 40-170 |
| D5-NEtFOSA | | 47 | 10-130 |
| D5-NEtFOSAA | | 70 | 25-135 |
| D7-NMeFOSE | | 71 | 10-130 |
| D9-NEtFOSE | | 67 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16518-002
Batch: 16518
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/20/2024 1708

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 97 | | 1 | 107 | 55-160 | 08/26/2024 1353 |
| 9Cl-PF3ONS | 90 | 110 | | 1 | 122 | 70-155 | 08/26/2024 1353 |
| ADONA | 91 | 100 | | 1 | 116 | 65-145 | 08/26/2024 1353 |
| 8:2FTS | 92 | 120 | | 1 | 132 | 60-150 | 08/26/2024 1353 |
| 4:2FTS | 90 | 110 | | 1 | 128 | 70-145 | 08/26/2024 1353 |
| 6:2FTS | 91 | 140 | | 1 | 149 | 65-155 | 08/26/2024 1353 |
| 5:3FTCA | 600 | 560 | | 1 | 93 | 70-135 | 08/26/2024 1353 |
| HFPO-DA | 96 | 110 | | 1 | 110 | 70-140 | 08/26/2024 1353 |
| NEtFOSA | 24 | 30 | | 1 | 126 | 65-145 | 08/26/2024 1353 |
| NEtFOSAA | 24 | 35 | NM-03 | 1 | 148 | 70-145 | 08/26/2024 1353 |
| NEtFOSE | 240 | 310 | | 1 | 128 | 70-135 | 08/26/2024 1353 |
| NMeFOSA | 24 | 32 | | 1 | 132 | 60-150 | 08/26/2024 1353 |
| NMeFOSAA | 24 | 31 | M-03 | 1 | 129 | 50-140 | 08/26/2024 1353 |
| NMeFOSE | 240 | 310 | | 1 | 129 | 70-145 | 08/26/2024 1353 |
| NFDHA | 48 | 52 | | 1 | 108 | 50-150 | 08/26/2024 1353 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 48 | | 1 | 111 | 70-140 | 08/26/2024 1353 |
| PFMPA | 48 | 53 | | 1 | 111 | 55-140 | 08/26/2024 1353 |
| PFMBA | 48 | 51 | | 1 | 106 | 60-150 | 08/26/2024 1353 |
| PFBS | 21 | 28 | | 1 | 131 | 60-145 | 08/26/2024 1353 |
| PFBA | 96 | 130 | | 1 | 131 | 70-140 | 08/26/2024 1353 |
| PFDS | 23 | 30 | | 1 | 127 | 60-145 | 08/26/2024 1353 |
| PFDA | 24 | 31 | | 1 | 128 | 70-140 | 08/26/2024 1353 |
| PFDoS | 23 | 25 | | 1 | 106 | 50-145 | 08/26/2024 1353 |
| PFDoA | 24 | 28 | | 1 | 118 | 70-140 | 08/26/2024 1353 |
| PFHpS | 23 | 29 | | 1 | 127 | 70-150 | 08/26/2024 1353 |
| PFHpA | 24 | 30 | | 1 | 125 | 70-150 | 08/26/2024 1353 |
| 7:3FTCA | 600 | 570 | | 1 | 95 | 50-145 | 08/26/2024 1353 |
| PFHxS | 22 | 24 | M-03 | 1 | 111 | 65-145 | 08/26/2024 1353 |
| PFHxA | 24 | 30 | | 1 | 125 | 70-145 | 08/26/2024 1353 |
| PFNS | 23 | 31 | | 1 | 133 | 65-145 | 08/26/2024 1353 |
| PFNA | 24 | 33 | | 1 | 136 | 70-150 | 08/26/2024 1353 |
| PFOSA | 24 | 31 | | 1 | 127 | 70-145 | 08/26/2024 1353 |
| PFOS | 22 | 28 | M-03 | 1 | 126 | 55-150 | 08/26/2024 1353 |
| PFOA | 24 | 33 | | 1 | 136 | 70-150 | 08/26/2024 1353 |
| PFPeS | 23 | 24 | | 1 | 107 | 65-140 | 08/26/2024 1353 |
| PFPeA | 48 | 62 | | 1 | 129 | 65-135 | 08/26/2024 1353 |
| 3:3FTCA | 120 | 130 | | 1 | 110 | 65-130 | 08/26/2024 1353 |
| PFTeDA | 24 | 31 | | 1 | 131 | 60-140 | 08/26/2024 1353 |
| PFTrDA | 24 | 30 | | 1 | 124 | 65-140 | 08/26/2024 1353 |
| PFUnA | 24 | 31 | | 1 | 127 | 70-145 | 08/26/2024 1353 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 79 | 40-200 |
| 13C2-6:2FTS | | 68 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16518-002
Batch: 16518
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/20/2024 1708

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 69 | 40-300 |
| 13C2-PFDoA | M-03 | 68 | 10-130 |
| 13C2-PFTeDA | | 64 | 10-130 |
| 13C3-HFPO-DA | | 79 | 40-130 |
| 13C3-PFBS | | 79 | 40-135 |
| 13C3-PFHxS | | 88 | 40-130 |
| 13C4-PFBA | | 80 | 5-130 |
| 13C4-PFHpA | | 80 | 40-130 |
| 13C5-PFHxA | | 79 | 40-130 |
| 13C5-PFPeA | | 79 | 40-130 |
| 13C6-PFDA | | 82 | 40-130 |
| 13C7-PFUnA | | 72 | 30-130 |
| 13C8-PFOA | | 77 | 40-130 |
| 13C8-PFOS | | 77 | 40-130 |
| 13C8-PFOSA | | 78 | 40-130 |
| 13C9-PFNA | | 77 | 40-130 |
| D3-NMeFOSA | | 54 | 10-130 |
| D3-NMeFOSAA | | 75 | 40-170 |
| D5-NEtFOSA | | 57 | 10-130 |
| D5-NEtFOSAA | | 66 | 25-135 |
| D7-NMeFOSE | | 69 | 10-130 |
| D9-NEtFOSE | | 67 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16518-102
Batch: 16518
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/20/2024 1708

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.7 | | 1 | 102 | 55-160 | 08/24/2024 0909 |
| 9Cl-PF3ONS | 7.5 | 8.5 | | 1 | 114 | 70-155 | 08/24/2024 0909 |
| ADONA | 7.6 | 8.9 | | 1 | 117 | 65-145 | 08/24/2024 0909 |
| 8:2FTS | 7.7 | 8.8 | M-03 | 1 | 115 | 60-150 | 08/24/2024 0909 |
| 4:2FTS | 7.5 | 8.1 | | 1 | 108 | 70-145 | 08/24/2024 0909 |
| 6:2FTS | 7.6 | 7.5 | | 1 | 99 | 65-155 | 08/24/2024 0909 |
| 5:3FTCA | 50 | 55 | | 1 | 110 | 70-135 | 08/24/2024 0909 |
| HFPO-DA | 8.0 | 8.1 | | 1 | 102 | 70-140 | 08/24/2024 0909 |
| NEtFOSA | 2.0 | 2.2 | M-03 | 1 | 108 | 65-145 | 08/24/2024 0909 |
| NEtFOSAA | 2.0 | 2.1 | | 1 | 106 | 70-145 | 08/24/2024 0909 |
| NEtFOSE | 20 | 21 | | 1 | 104 | 70-135 | 08/24/2024 0909 |
| NMeFOSA | 2.0 | 2.1 | | 1 | 103 | 60-150 | 08/24/2024 0909 |
| NMeFOSAA | 2.0 | 2.1 | | 1 | 105 | 50-140 | 08/24/2024 0909 |
| NMeFOSE | 20 | 21 | | 1 | 106 | 70-145 | 08/24/2024 0909 |
| NFDHA | 4.0 | 4.3 | | 1 | 107 | 50-150 | 08/24/2024 0909 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.1 | | 1 | 116 | 70-140 | 08/24/2024 0909 |
| PFMPA | 4.0 | 3.9 | | 1 | 99 | 55-140 | 08/24/2024 0909 |
| PFMBA | 4.0 | 3.9 | | 1 | 97 | 60-150 | 08/24/2024 0909 |
| PFBS | 1.8 | 1.8 | | 1 | 100 | 60-145 | 08/24/2024 0909 |
| PFBA | 8.0 | 8.5 | | 1 | 106 | 70-140 | 08/24/2024 0909 |
| PFDS | 1.9 | 1.9 | | 1 | 101 | 60-145 | 08/24/2024 0909 |
| PFDA | 2.0 | 2.1 | | 1 | 103 | 70-140 | 08/24/2024 0909 |
| PFDoS | 1.9 | 1.8 | | 1 | 94 | 50-145 | 08/24/2024 0909 |
| PFDoA | 2.0 | 1.9 | M-03 | 1 | 97 | 70-140 | 08/24/2024 0909 |
| PFHpS | 1.9 | 2.4 | M-03 | 1 | 125 | 70-150 | 08/24/2024 0909 |
| PFHpA | 2.0 | 2.2 | M-03 | 1 | 108 | 70-150 | 08/24/2024 0909 |
| 7:3FTCA | 50 | 54 | | 1 | 108 | 50-145 | 08/24/2024 0909 |
| PFHxS | 1.8 | 1.9 | | 1 | 106 | 65-145 | 08/24/2024 0909 |
| PFHxA | 2.0 | 2.1 | M-03 | 1 | 106 | 70-145 | 08/24/2024 0909 |
| PFNS | 1.9 | 2.3 | | 1 | 117 | 65-145 | 08/24/2024 0909 |
| PFNA | 2.0 | 2.1 | M-03 | 1 | 104 | 70-150 | 08/24/2024 0909 |
| PFOSA | 2.0 | 2.0 | | 1 | 100 | 70-145 | 08/24/2024 0909 |
| PFOS | 1.9 | 2.6 | M-03 | 1 | 141 | 55-150 | 08/24/2024 0909 |
| PFOA | 2.0 | 2.3 | M-03 | 1 | 115 | 70-150 | 08/24/2024 0909 |
| PFPeS | 1.9 | 1.9 | | 1 | 103 | 65-140 | 08/24/2024 0909 |
| PFPeA | 4.0 | 4.1 | M-03 | 1 | 104 | 65-135 | 08/24/2024 0909 |
| 3:3FTCA | 10 | 9.3 | | 1 | 93 | 65-130 | 08/24/2024 0909 |
| PFTeDA | 2.0 | 1.8 | | 1 | 91 | 60-140 | 08/24/2024 0909 |
| PFTrDA | 2.0 | 1.7 | | 1 | 86 | 65-140 | 08/24/2024 0909 |
| PFUnA | 2.0 | 2.0 | | 1 | 99 | 70-145 | 08/24/2024 0909 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 86 | 40-200 |
| 13C2-6:2FTS | | 90 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16518-102
Batch: 16518
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/20/2024 1708

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 81 | 40-300 |
| 13C2-PFDoA | | 71 | 10-130 |
| 13C2-PFTeDA | | 67 | 10-130 |
| 13C3-HFPO-DA | | 83 | 40-130 |
| 13C3-PFBS | | 88 | 40-135 |
| 13C3-PFHxS | | 95 | 40-130 |
| 13C4-PFBA | | 86 | 5-130 |
| 13C4-PFHpA | | 80 | 40-130 |
| 13C5-PFHxA | | 80 | 40-130 |
| 13C5-PFPeA | | 84 | 40-130 |
| 13C6-PFDA | | 83 | 40-130 |
| 13C7-PFUnA | | 77 | 30-130 |
| 13C8-PFOA | | 79 | 40-130 |
| 13C8-PFOS | | 76 | 40-130 |
| 13C8-PFOSA | | 86 | 40-130 |
| 13C9-PFNA | | 77 | 40-130 |
| D3-NMeFOSA | | 65 | 10-130 |
| D3-NMeFOSAA | | 81 | 40-170 |
| D5-NEtFOSA | | 66 | 10-130 |
| D5-NEtFOSAA | | 72 | 25-135 |
| D7-NMeFOSE | | 76 | 10-130 |
| D9-NEtFOSE | | 75 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16574-001
Batch: 16574
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/21/2024 1616

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 08/23/2024 0439 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 08/23/2024 0439 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 08/23/2024 0439 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 08/23/2024 0439 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 08/23/2024 0439 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 08/23/2024 0439 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 08/23/2024 0439 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 08/23/2024 0439 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 08/23/2024 0439 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/23/2024 0439 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 08/23/2024 0439 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 08/23/2024 0439 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/23/2024 0439 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 08/23/2024 0439 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 08/23/2024 0439 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 08/23/2024 0439 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 08/23/2024 0439 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 08/23/2024 0439 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 08/23/2024 0439 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 08/23/2024 0439 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 08/23/2024 0439 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/23/2024 0439 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 08/23/2024 0439 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 08/23/2024 0439 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 08/23/2024 0439 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/23/2024 0439 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 08/23/2024 0439 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 08/23/2024 0439 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/23/2024 0439 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 08/23/2024 0439 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 08/23/2024 0439 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 08/23/2024 0439 |
| PFOS | 0.74 | UM-03 | 1 | 1.0 | 0.74 | 0.25 | ng/L | 08/23/2024 0439 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/23/2024 0439 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 08/23/2024 0439 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 08/23/2024 0439 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 08/23/2024 0439 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 08/23/2024 0439 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 08/23/2024 0439 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 08/23/2024 0439 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 78 | 40-200 |
| 13C2-6:2FTS | | 71 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16574-001
Batch: 16574
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/21/2024 1616

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 74 | 40-300 |
| 13C2-PFDoA | | 68 | 10-130 |
| 13C2-PFTeDA | | 63 | 10-130 |
| 13C3-HFPO-DA | | 78 | 40-130 |
| 13C3-PFBS | | 77 | 40-135 |
| 13C3-PFHxS | | 77 | 40-130 |
| 13C4-PFBA | | 81 | 5-130 |
| 13C4-PFHpA | | 83 | 40-130 |
| 13C5-PFHxA | | 79 | 40-130 |
| 13C5-PFPeA | | 79 | 40-130 |
| 13C6-PFDA | | 78 | 40-130 |
| 13C7-PFUnA | | 67 | 30-130 |
| 13C8-PFOA | | 82 | 40-130 |
| 13C8-PFOS | | 78 | 40-130 |
| 13C8-PFOSA | | 70 | 40-130 |
| 13C9-PFNA | | 80 | 40-130 |
| D3-NMeFOSA | | 43 | 10-130 |
| D3-NMeFOSAA | | 71 | 40-170 |
| D5-NEtFOSA | | 43 | 10-130 |
| D5-NEtFOSAA | | 68 | 25-135 |
| D7-NMeFOSE | | 63 | 10-130 |
| D9-NEtFOSE | | 64 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16574-002
Batch: 16574
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/21/2024 1616

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 93 | | 1 | 103 | 55-160 | 08/23/2024 0448 |
| 9Cl-PF3ONS | 90 | 110 | | 1 | 118 | 70-155 | 08/23/2024 0448 |
| ADONA | 91 | 100 | | 1 | 110 | 65-145 | 08/23/2024 0448 |
| 8:2FTS | 92 | 86 | | 1 | 94 | 60-150 | 08/23/2024 0448 |
| 4:2FTS | 90 | 82 | | 1 | 91 | 70-145 | 08/23/2024 0448 |
| 6:2FTS | 91 | 82 | | 1 | 90 | 65-155 | 08/23/2024 0448 |
| 5:3FTCA | 600 | 560 | | 1 | 93 | 70-135 | 08/23/2024 0448 |
| HFPO-DA | 96 | 98 | | 1 | 102 | 70-140 | 08/23/2024 0448 |
| NEtFOSA | 24 | 20 | | 1 | 83 | 65-145 | 08/23/2024 0448 |
| NEtFOSAA | 24 | 20 | | 1 | 83 | 70-145 | 08/23/2024 0448 |
| NEtFOSE | 240 | 200 | | 1 | 82 | 70-135 | 08/23/2024 0448 |
| NMeFOSA | 24 | 21 | | 1 | 85 | 60-150 | 08/23/2024 0448 |
| NMeFOSAA | 24 | 19 | | 1 | 79 | 50-140 | 08/23/2024 0448 |
| NMeFOSE | 240 | 190 | | 1 | 80 | 70-145 | 08/23/2024 0448 |
| NFDHA | 48 | 40 | | 1 | 83 | 50-150 | 08/23/2024 0448 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 40 | | 1 | 92 | 70-140 | 08/23/2024 0448 |
| PFMPA | 48 | 45 | | 1 | 93 | 55-140 | 08/23/2024 0448 |
| PFMBA | 48 | 42 | | 1 | 87 | 60-150 | 08/23/2024 0448 |
| PFBS | 21 | 18 | | 1 | 83 | 60-145 | 08/23/2024 0448 |
| PFBA | 96 | 84 | | 1 | 87 | 70-140 | 08/23/2024 0448 |
| PFDS | 23 | 18 | | 1 | 78 | 60-145 | 08/23/2024 0448 |
| PFDA | 24 | 20 | | 1 | 83 | 70-140 | 08/23/2024 0448 |
| PFDoS | 23 | 17 | | 1 | 72 | 50-145 | 08/23/2024 0448 |
| PFDoA | 24 | 20 | | 1 | 85 | 70-140 | 08/23/2024 0448 |
| PFHpS | 23 | 19 | | 1 | 85 | 70-150 | 08/23/2024 0448 |
| PFHpA | 24 | 20 | | 1 | 81 | 70-150 | 08/23/2024 0448 |
| 7:3FTCA | 600 | 500 | | 1 | 83 | 50-145 | 08/23/2024 0448 |
| PFHxS | 22 | 19 | M-03 | 1 | 86 | 65-145 | 08/23/2024 0448 |
| PFHxA | 24 | 21 | | 1 | 89 | 70-145 | 08/23/2024 0448 |
| PFNS | 23 | 19 | | 1 | 84 | 65-145 | 08/23/2024 0448 |
| PFNA | 24 | 19 | | 1 | 77 | 70-150 | 08/23/2024 0448 |
| PFOSA | 24 | 21 | | 1 | 88 | 70-145 | 08/23/2024 0448 |
| PFOS | 22 | 18 | M-03 | 1 | 81 | 55-150 | 08/23/2024 0448 |
| PFOA | 24 | 19 | | 1 | 77 | 70-150 | 08/23/2024 0448 |
| PFPeS | 23 | 20 | | 1 | 87 | 65-140 | 08/23/2024 0448 |
| PFPeA | 48 | 41 | | 1 | 86 | 65-135 | 08/23/2024 0448 |
| 3:3FTCA | 120 | 110 | | 1 | 91 | 65-130 | 08/23/2024 0448 |
| PFTeDA | 24 | 19 | | 1 | 81 | 60-140 | 08/23/2024 0448 |
| PFTrDA | 24 | 19 | | 1 | 79 | 65-140 | 08/23/2024 0448 |
| PFUnA | 24 | 21 | | 1 | 89 | 70-145 | 08/23/2024 0448 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 86 | 40-200 |
| 13C2-6:2FTS | | 84 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16574-002
Batch: 16574
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/21/2024 1616

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 81 | 40-300 |
| 13C2-PFDoA | | 72 | 10-130 |
| 13C2-PFTeDA | | 71 | 10-130 |
| 13C3-HFPO-DA | | 80 | 40-130 |
| 13C3-PFBS | | 86 | 40-135 |
| 13C3-PFHxS | | 86 | 40-130 |
| 13C4-PFBA | | 87 | 5-130 |
| 13C4-PFHpA | | 84 | 40-130 |
| 13C5-PFHxA | | 80 | 40-130 |
| 13C5-PFPeA | | 81 | 40-130 |
| 13C6-PFDA | | 89 | 40-130 |
| 13C7-PFUnA | | 76 | 30-130 |
| 13C8-PFOA | | 85 | 40-130 |
| 13C8-PFOS | | 83 | 40-130 |
| 13C8-PFOSA | | 78 | 40-130 |
| 13C9-PFNA | | 91 | 40-130 |
| D3-NMeFOSA | | 49 | 10-130 |
| D3-NMeFOSAA | | 87 | 40-170 |
| D5-NEtFOSA | | 51 | 10-130 |
| D5-NEtFOSAA | | 79 | 25-135 |
| D7-NMeFOSE | | 72 | 10-130 |
| D9-NEtFOSE | | 71 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16574-102
Batch: 16574
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/21/2024 1616

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.9 | | 1 | 104 | 55-160 | 08/23/2024 0457 |
| 9Cl-PF3ONS | 7.5 | 8.7 | | 1 | 116 | 70-155 | 08/23/2024 0457 |
| ADONA | 7.6 | 8.2 | | 1 | 108 | 65-145 | 08/23/2024 0457 |
| 8:2FTS | 7.7 | 7.7 | M-03 | 1 | 100 | 60-150 | 08/23/2024 0457 |
| 4:2FTS | 7.5 | 7.8 | | 1 | 104 | 70-145 | 08/23/2024 0457 |
| 6:2FTS | 7.6 | 9.2 | | 1 | 121 | 65-155 | 08/23/2024 0457 |
| 5:3FTCA | 50 | 53 | M-03 | 1 | 106 | 70-135 | 08/23/2024 0457 |
| HFPO-DA | 8.0 | 8.1 | | 1 | 101 | 70-140 | 08/23/2024 0457 |
| NEtFOSA | 2.0 | 2.3 | | 1 | 113 | 65-145 | 08/23/2024 0457 |
| NEtFOSAA | 2.0 | 2.5 | M-03 | 1 | 123 | 70-145 | 08/23/2024 0457 |
| NEtFOSE | 20 | 21 | | 1 | 104 | 70-135 | 08/23/2024 0457 |
| NMeFOSA | 2.0 | 2.4 | | 1 | 119 | 60-150 | 08/23/2024 0457 |
| NMeFOSAA | 2.0 | 2.0 | M-03 | 1 | 102 | 50-140 | 08/23/2024 0457 |
| NMeFOSE | 20 | 20 | | 1 | 98 | 70-145 | 08/23/2024 0457 |
| NFDHA | 4.0 | 3.9 | | 1 | 96 | 50-150 | 08/23/2024 0457 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.5 | | 1 | 98 | 70-140 | 08/23/2024 0457 |
| PFMPA | 4.0 | 4.3 | M-03 | 1 | 108 | 55-140 | 08/23/2024 0457 |
| PFMBA | 4.0 | 3.9 | | 1 | 98 | 60-150 | 08/23/2024 0457 |
| PFBS | 1.8 | 1.8 | M-03 | 1 | 99 | 60-145 | 08/23/2024 0457 |
| PFBA | 8.0 | 8.4 | M-03 | 1 | 105 | 70-140 | 08/23/2024 0457 |
| PFDS | 1.9 | 2.0 | | 1 | 105 | 60-145 | 08/23/2024 0457 |
| PFDA | 2.0 | 2.1 | M-03 | 1 | 106 | 70-140 | 08/23/2024 0457 |
| PFDoS | 1.9 | 1.7 | | 1 | 86 | 50-145 | 08/23/2024 0457 |
| PFDoA | 2.0 | 2.1 | M-03 | 1 | 105 | 70-140 | 08/23/2024 0457 |
| PFHpS | 1.9 | 2.4 | M-03 | 1 | 126 | 70-150 | 08/23/2024 0457 |
| PFHpA | 2.0 | 1.9 | M-03 | 1 | 96 | 70-150 | 08/23/2024 0457 |
| 7:3FTCA | 50 | 50 | M-03 | 1 | 100 | 50-145 | 08/23/2024 0457 |
| PFHxS | 1.8 | 1.9 | M-03 | 1 | 103 | 65-145 | 08/23/2024 0457 |
| PFHxA | 2.0 | 1.8 | | 1 | 92 | 70-145 | 08/23/2024 0457 |
| PFNS | 1.9 | 1.8 | | 1 | 95 | 65-145 | 08/23/2024 0457 |
| PFNA | 2.0 | 2.7 | M-03 | 1 | 137 | 70-150 | 08/23/2024 0457 |
| PFOSA | 2.0 | 2.2 | M-03 | 1 | 109 | 70-145 | 08/23/2024 0457 |
| PFOS | 1.9 | 1.8 | M-03 | 1 | 96 | 55-150 | 08/23/2024 0457 |
| PFOA | 2.0 | 2.1 | M-03 | 1 | 105 | 70-150 | 08/23/2024 0457 |
| PFPeS | 1.9 | 1.8 | | 1 | 98 | 65-140 | 08/23/2024 0457 |
| PFPeA | 4.0 | 4.1 | | 1 | 102 | 65-135 | 08/23/2024 0457 |
| 3:3FTCA | 10 | 11 | | 1 | 111 | 65-130 | 08/23/2024 0457 |
| PFTeDA | 2.0 | 2.1 | | 1 | 107 | 60-140 | 08/23/2024 0457 |
| PFTrDA | 2.0 | 2.2 | M-03 | 1 | 108 | 65-140 | 08/23/2024 0457 |
| PFUnA | 2.0 | 2.3 | M-03 | 1 | 113 | 70-145 | 08/23/2024 0457 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 81 | 40-200 |
| 13C2-6:2FTS | | 77 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16574-102
Batch: 16574
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/21/2024 1616

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 80 | 40-300 |
| 13C2-PFDoA | | 71 | 10-130 |
| 13C2-PFTeDA | | 67 | 10-130 |
| 13C3-HFPO-DA | | 84 | 40-130 |
| 13C3-PFBS | | 82 | 40-135 |
| 13C3-PFHxS | | 82 | 40-130 |
| 13C4-PFBA | | 87 | 5-130 |
| 13C4-PFHpA | | 87 | 40-130 |
| 13C5-PFHxA | | 88 | 40-130 |
| 13C5-PFPeA | | 86 | 40-130 |
| 13C6-PFDA | | 82 | 40-130 |
| 13C7-PFUnA | | 70 | 30-130 |
| 13C8-PFOA | | 83 | 40-130 |
| 13C8-PFOS | | 87 | 40-130 |
| 13C8-PFOSA | | 83 | 40-130 |
| 13C9-PFNA | | 83 | 40-130 |
| D3-NMeFOSA | | 55 | 10-130 |
| D3-NMeFOSAA | | 85 | 40-170 |
| D5-NEtFOSA | | 55 | 10-130 |
| D5-NEtFOSAA | | 77 | 25-135 |
| D7-NMeFOSE | | 77 | 10-130 |
| D9-NEtFOSE | | 73 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16603-001
Batch: 16603
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/22/2024 1636

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 08/24/2024 0423 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 08/24/2024 0423 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 08/24/2024 0423 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 08/24/2024 0423 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 08/24/2024 0423 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 08/24/2024 0423 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 08/24/2024 0423 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 08/24/2024 0423 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 08/24/2024 0423 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/24/2024 0423 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 08/24/2024 0423 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 08/24/2024 0423 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/24/2024 0423 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 08/24/2024 0423 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 08/24/2024 0423 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 08/24/2024 0423 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 08/24/2024 0423 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 08/24/2024 0423 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 08/24/2024 0423 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 08/24/2024 0423 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 08/24/2024 0423 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/24/2024 0423 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 08/24/2024 0423 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 08/24/2024 0423 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 08/24/2024 0423 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/24/2024 0423 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 08/24/2024 0423 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 08/24/2024 0423 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/24/2024 0423 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 08/24/2024 0423 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 08/24/2024 0423 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 08/24/2024 0423 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 08/24/2024 0423 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/24/2024 0423 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 08/24/2024 0423 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 08/24/2024 0423 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 08/24/2024 0423 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 08/24/2024 0423 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 08/24/2024 0423 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 08/24/2024 0423 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 83 | 40-200 |
| 13C2-6:2FTS | | 81 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16603-001
Batch: 16603
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/22/2024 1636

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 81 | 40-300 |
| 13C2-PFDoA | | 73 | 10-130 |
| 13C2-PFTeDA | | 75 | 10-130 |
| 13C3-HFPO-DA | | 87 | 40-130 |
| 13C3-PFBS | | 80 | 40-135 |
| 13C3-PFHxS | | 82 | 40-130 |
| 13C4-PFBA | | 88 | 5-130 |
| 13C4-PFHpA | | 89 | 40-130 |
| 13C5-PFHxA | | 81 | 40-130 |
| 13C5-PFPeA | | 86 | 40-130 |
| 13C6-PFDA | | 85 | 40-130 |
| 13C7-PFUnA | | 86 | 30-130 |
| 13C8-PFOA | | 87 | 40-130 |
| 13C8-PFOS | | 79 | 40-130 |
| 13C8-PFOSA | | 83 | 40-130 |
| 13C9-PFNA | | 90 | 40-130 |
| D3-NMeFOSA | | 49 | 10-130 |
| D3-NMeFOSAA | | 88 | 40-170 |
| D5-NEtFOSA | | 49 | 10-130 |
| D5-NEtFOSAA | | 79 | 25-135 |
| D7-NMeFOSE | | 77 | 10-130 |
| D9-NEtFOSE | | 75 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16603-002
Batch: 16603
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/22/2024 1636

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 96 | | 1 | 105 | 55-160 | 08/24/2024 0432 |
| 9Cl-PF3ONS | 90 | 100 | | 1 | 116 | 70-155 | 08/24/2024 0432 |
| ADONA | 91 | 100 | | 1 | 112 | 65-145 | 08/24/2024 0432 |
| 8:2FTS | 92 | 75 | | 1 | 82 | 60-150 | 08/24/2024 0432 |
| 4:2FTS | 90 | 78 | | 1 | 87 | 70-145 | 08/24/2024 0432 |
| 6:2FTS | 91 | 84 | | 1 | 92 | 65-155 | 08/24/2024 0432 |
| 5:3FTCA | 600 | 520 | | 1 | 87 | 70-135 | 08/24/2024 0432 |
| HFPO-DA | 96 | 97 | | 1 | 101 | 70-140 | 08/24/2024 0432 |
| NEtFOSA | 24 | 20 | | 1 | 82 | 65-145 | 08/24/2024 0432 |
| NEtFOSAA | 24 | 18 | M-03 | 1 | 76 | 70-145 | 08/24/2024 0432 |
| NEtFOSE | 240 | 190 | | 1 | 79 | 70-135 | 08/24/2024 0432 |
| NMeFOSA | 24 | 19 | | 1 | 79 | 60-150 | 08/24/2024 0432 |
| NMeFOSAA | 24 | 18 | M-03 | 1 | 73 | 50-140 | 08/24/2024 0432 |
| NMeFOSE | 240 | 190 | | 1 | 78 | 70-145 | 08/24/2024 0432 |
| NFDHA | 48 | 36 | | 1 | 76 | 50-150 | 08/24/2024 0432 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 36 | | 1 | 84 | 70-140 | 08/24/2024 0432 |
| PFMPA | 48 | 41 | | 1 | 86 | 55-140 | 08/24/2024 0432 |
| PFMBA | 48 | 38 | | 1 | 79 | 60-150 | 08/24/2024 0432 |
| PFBS | 21 | 18 | | 1 | 83 | 60-145 | 08/24/2024 0432 |
| PFBA | 96 | 78 | | 1 | 82 | 70-140 | 08/24/2024 0432 |
| PFDS | 23 | 18 | | 1 | 77 | 60-145 | 08/24/2024 0432 |
| PFDA | 24 | 18 | | 1 | 75 | 70-140 | 08/24/2024 0432 |
| PFDoS | 23 | 16 | | 1 | 68 | 50-145 | 08/24/2024 0432 |
| PFDoA | 24 | 19 | | 1 | 80 | 70-140 | 08/24/2024 0432 |
| PFHpS | 23 | 19 | | 1 | 82 | 70-150 | 08/24/2024 0432 |
| PFHpA | 24 | 20 | | 1 | 83 | 70-150 | 08/24/2024 0432 |
| 7:3FTCA | 600 | 510 | | 1 | 85 | 50-145 | 08/24/2024 0432 |
| PFHxS | 22 | 17 | | 1 | 78 | 65-145 | 08/24/2024 0432 |
| PFHxA | 24 | 20 | | 1 | 85 | 70-145 | 08/24/2024 0432 |
| PFNS | 23 | 18 | | 1 | 79 | 65-145 | 08/24/2024 0432 |
| PFNA | 24 | 17 | N | 1 | 69 | 70-150 | 08/24/2024 0432 |
| PFOSA | 24 | 20 | | 1 | 82 | 70-145 | 08/24/2024 0432 |
| PFOS | 22 | 18 | M-03 | 1 | 80 | 55-150 | 08/24/2024 0432 |
| PFOA | 24 | 19 | | 1 | 79 | 70-150 | 08/24/2024 0432 |
| PFPeS | 23 | 18 | | 1 | 81 | 65-140 | 08/24/2024 0432 |
| PFPeA | 48 | 38 | | 1 | 80 | 65-135 | 08/24/2024 0432 |
| 3:3FTCA | 120 | 110 | | 1 | 91 | 65-130 | 08/24/2024 0432 |
| PFTeDA | 24 | 20 | | 1 | 81 | 60-140 | 08/24/2024 0432 |
| PFTrDA | 24 | 19 | | 1 | 79 | 65-140 | 08/24/2024 0432 |
| PFUnA | 24 | 21 | | 1 | 85 | 70-145 | 08/24/2024 0432 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | M-03 | 92 | 40-200 |
| 13C2-6:2FTS | | 85 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16603-002
Batch: 16603
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/22/2024 1636

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 92 | 40-300 |
| 13C2-PFDoA | | 77 | 10-130 |
| 13C2-PFTeDA | | 74 | 10-130 |
| 13C3-HFPO-DA | | 88 | 40-130 |
| 13C3-PFBS | | 93 | 40-135 |
| 13C3-PFHxS | | 89 | 40-130 |
| 13C4-PFBA | | 92 | 5-130 |
| 13C4-PFHpA | | 92 | 40-130 |
| 13C5-PFHxA | | 89 | 40-130 |
| 13C5-PFPeA | | 89 | 40-130 |
| 13C6-PFDA | | 95 | 40-130 |
| 13C7-PFUnA | | 84 | 30-130 |
| 13C8-PFOA | | 89 | 40-130 |
| 13C8-PFOS | | 92 | 40-130 |
| 13C8-PFOSA | | 87 | 40-130 |
| 13C9-PFNA | | 102 | 40-130 |
| D3-NMeFOSA | | 48 | 10-130 |
| D3-NMeFOSAA | | 99 | 40-170 |
| D5-NEtFOSA | | 47 | 10-130 |
| D5-NEtFOSAA | | 86 | 25-135 |
| D7-NMeFOSE | | 81 | 10-130 |
| D9-NEtFOSE | | 80 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16603-102
Batch: 16603
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/22/2024 1636

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 7.1 | | 1 | 94 | 55-160 | 08/24/2024 0441 |
| 9Cl-PF3ONS | 7.5 | 7.4 | | 1 | 99 | 70-155 | 08/24/2024 0441 |
| ADONA | 7.6 | 7.2 | | 1 | 95 | 65-145 | 08/24/2024 0441 |
| 8:2FTS | 7.7 | 7.2 | M-03 | 1 | 94 | 60-150 | 08/24/2024 0441 |
| 4:2FTS | 7.5 | 5.9 | | 1 | 79 | 70-145 | 08/24/2024 0441 |
| 6:2FTS | 7.6 | 6.4 | M-03 | 1 | 84 | 65-155 | 08/24/2024 0441 |
| 5:3FTCA | 50 | 43 | | 1 | 86 | 70-135 | 08/24/2024 0441 |
| HFPO-DA | 8.0 | 7.6 | M-03 | 1 | 95 | 70-140 | 08/24/2024 0441 |
| NEtFOSA | 2.0 | 1.7 | M-03 | 1 | 84 | 65-145 | 08/24/2024 0441 |
| NEtFOSAA | 2.0 | 1.6 | | 1 | 82 | 70-145 | 08/24/2024 0441 |
| NEtFOSE | 20 | 17 | | 1 | 86 | 70-135 | 08/24/2024 0441 |
| NMeFOSA | 2.0 | 1.7 | | 1 | 85 | 60-150 | 08/24/2024 0441 |
| NMeFOSAA | 2.0 | 1.5 | | 1 | 73 | 50-140 | 08/24/2024 0441 |
| NMeFOSE | 20 | 17 | | 1 | 83 | 70-145 | 08/24/2024 0441 |
| NFDHA | 4.0 | 3.1 | | 1 | 77 | 50-150 | 08/24/2024 0441 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 3.1 | | 1 | 86 | 70-140 | 08/24/2024 0441 |
| PFMPA | 4.0 | 3.6 | | 1 | 91 | 55-140 | 08/24/2024 0441 |
| PFMBA | 4.0 | 3.2 | | 1 | 81 | 60-150 | 08/24/2024 0441 |
| PFBS | 1.8 | 1.4 | | 1 | 77 | 60-145 | 08/24/2024 0441 |
| PFBA | 8.0 | 6.9 | M-03 | 1 | 86 | 70-140 | 08/24/2024 0441 |
| PFDS | 1.9 | 1.6 | M-03 | 1 | 84 | 60-145 | 08/24/2024 0441 |
| PFDA | 2.0 | 1.7 | M-03 | 1 | 84 | 70-140 | 08/24/2024 0441 |
| PFDoS | 1.9 | 1.4 | M-03 | 1 | 74 | 50-145 | 08/24/2024 0441 |
| PFDoA | 2.0 | 1.6 | M-03 | 1 | 80 | 70-140 | 08/24/2024 0441 |
| PFHpS | 1.9 | 1.6 | | 1 | 83 | 70-150 | 08/24/2024 0441 |
| PFHpA | 2.0 | 1.7 | | 1 | 86 | 70-150 | 08/24/2024 0441 |
| 7:3FTCA | 50 | 42 | | 1 | 84 | 50-145 | 08/24/2024 0441 |
| PFHxS | 1.8 | 1.5 | M-03 | 1 | 85 | 65-145 | 08/24/2024 0441 |
| PFHxA | 2.0 | 1.7 | M-03 | 1 | 86 | 70-145 | 08/24/2024 0441 |
| PFNS | 1.9 | 1.7 | M-03 | 1 | 87 | 65-145 | 08/24/2024 0441 |
| PFNA | 2.0 | 1.5 | M-03 | 1 | 73 | 70-150 | 08/24/2024 0441 |
| PFOSA | 2.0 | 1.8 | M-03 | 1 | 92 | 70-145 | 08/24/2024 0441 |
| PFOS | 1.9 | 1.6 | M-03 | 1 | 87 | 55-150 | 08/24/2024 0441 |
| PFOA | 2.0 | 1.5 | M-03 | 1 | 77 | 70-150 | 08/24/2024 0441 |
| PFPeS | 1.9 | 1.6 | M-03 | 1 | 84 | 65-140 | 08/24/2024 0441 |
| PFPeA | 4.0 | 3.5 | M-03 | 1 | 88 | 65-135 | 08/24/2024 0441 |
| 3:3FTCA | 10 | 9.9 | | 1 | 99 | 65-130 | 08/24/2024 0441 |
| PFTeDA | 2.0 | 1.9 | M-03 | 1 | 96 | 60-140 | 08/24/2024 0441 |
| PFTrDA | 2.0 | 1.7 | M-03 | 1 | 87 | 65-140 | 08/24/2024 0441 |
| PFUnA | 2.0 | 1.7 | M-03 | 1 | 87 | 70-145 | 08/24/2024 0441 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 98 | 40-200 |
| 13C2-6:2FTS | | 93 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16603-102
Batch: 16603
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/22/2024 1636

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 86 | 40-300 |
| 13C2-PFDoA | | 79 | 10-130 |
| 13C2-PFTeDA | | 74 | 10-130 |
| 13C3-HFPO-DA | | 87 | 40-130 |
| 13C3-PFBS | | 92 | 40-135 |
| 13C3-PFHxS | | 90 | 40-130 |
| 13C4-PFBA | | 91 | 5-130 |
| 13C4-PFHpA | | 94 | 40-130 |
| 13C5-PFHxA | | 89 | 40-130 |
| 13C5-PFPeA | | 87 | 40-130 |
| 13C6-PFDA | | 94 | 40-130 |
| 13C7-PFUnA | | 81 | 30-130 |
| 13C8-PFOA | | 91 | 40-130 |
| 13C8-PFOS | | 88 | 40-130 |
| 13C8-PFOSA | | 89 | 40-130 |
| 13C9-PFNA | | 92 | 40-130 |
| D3-NMeFOSA | | 51 | 10-130 |
| D3-NMeFOSAA | | 89 | 40-170 |
| D5-NEtFOSA | | 52 | 10-130 |
| D5-NEtFOSAA | | 80 | 25-135 |
| D7-NMeFOSE | | 84 | 10-130 |
| D9-NEtFOSE | | 81 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16856-001
Batch: 16856
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/23/2024 1526

| Parameter | Result | Q | Dil | LOQ | LOD | DL | Units | Analysis Date |
|---|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 2.3 | U | 1 | 4.0 | 2.3 | 0.87 | ng/L | 08/27/2024 0143 |
| 9Cl-PF3ONS | 2.2 | U | 1 | 4.0 | 2.2 | 0.67 | ng/L | 08/27/2024 0143 |
| ADONA | 2.3 | U | 1 | 4.0 | 2.3 | 0.66 | ng/L | 08/27/2024 0143 |
| 8:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.61 | ng/L | 08/27/2024 0143 |
| 4:2FTS | 1.5 | U | 1 | 4.0 | 1.5 | 0.40 | ng/L | 08/27/2024 0143 |
| 6:2FTS | 4.6 | U | 1 | 5.0 | 4.6 | 2.0 | ng/L | 08/27/2024 0143 |
| 5:3FTCA | 10 | U | 1 | 25 | 10 | 4.3 | ng/L | 08/27/2024 0143 |
| HFPO-DA | 2.4 | U | 1 | 4.0 | 2.4 | 0.99 | ng/L | 08/27/2024 0143 |
| NEtFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.13 | ng/L | 08/27/2024 0143 |
| NEtFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/27/2024 0143 |
| NEtFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.61 | ng/L | 08/27/2024 0143 |
| NMeFOSA | 0.80 | U | 1 | 1.0 | 0.80 | 0.22 | ng/L | 08/27/2024 0143 |
| NMeFOSAA | 0.80 | U | 1 | 1.0 | 0.80 | 0.29 | ng/L | 08/27/2024 0143 |
| NMeFOSE | 2.0 | U | 1 | 10 | 2.0 | 0.63 | ng/L | 08/27/2024 0143 |
| NFDHA | 1.3 | U | 1 | 2.0 | 1.3 | 0.58 | ng/L | 08/27/2024 0143 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 1.1 | U | 1 | 2.0 | 1.1 | 0.36 | ng/L | 08/27/2024 0143 |
| PFMPA | 0.64 | U | 1 | 2.0 | 0.64 | 0.18 | ng/L | 08/27/2024 0143 |
| PFMBA | 1.3 | U | 1 | 2.0 | 1.3 | 0.39 | ng/L | 08/27/2024 0143 |
| PFBS | 0.35 | U | 1 | 1.0 | 0.35 | 0.094 | ng/L | 08/27/2024 0143 |
| PFBA | 1.6 | U | 1 | 4.0 | 1.6 | 0.51 | ng/L | 08/27/2024 0143 |
| PFDS | 0.39 | U | 1 | 1.0 | 0.39 | 0.16 | ng/L | 08/27/2024 0143 |
| PFDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/27/2024 0143 |
| PFDoS | 0.39 | U | 1 | 1.0 | 0.39 | 0.15 | ng/L | 08/27/2024 0143 |
| PFDoA | 0.40 | U | 1 | 1.0 | 0.40 | 0.11 | ng/L | 08/27/2024 0143 |
| PFHpS | 0.38 | U | 1 | 1.0 | 0.38 | 0.19 | ng/L | 08/27/2024 0143 |
| PFHpA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/27/2024 0143 |
| 7:3FTCA | 10 | U | 1 | 25 | 10 | 4.2 | ng/L | 08/27/2024 0143 |
| PFHxS | 0.73 | U | 1 | 1.0 | 0.73 | 0.18 | ng/L | 08/27/2024 0143 |
| PFHxA | 0.40 | U | 1 | 1.0 | 0.40 | 0.14 | ng/L | 08/27/2024 0143 |
| PFNS | 0.38 | U | 1 | 1.0 | 0.38 | 0.15 | ng/L | 08/27/2024 0143 |
| PFNA | 0.40 | U | 1 | 1.0 | 0.40 | 0.10 | ng/L | 08/27/2024 0143 |
| PFOSA | 0.40 | U | 1 | 1.0 | 0.40 | 0.20 | ng/L | 08/27/2024 0143 |
| PFOS | 0.74 | U | 1 | 1.0 | 0.74 | 0.25 | ng/L | 08/27/2024 0143 |
| PFOA | 0.80 | U | 1 | 1.0 | 0.80 | 0.21 | ng/L | 08/27/2024 0143 |
| PFPeS | 0.75 | U | 1 | 1.0 | 0.75 | 0.26 | ng/L | 08/27/2024 0143 |
| PFPeA | 0.40 | U | 1 | 2.0 | 0.40 | 0.18 | ng/L | 08/27/2024 0143 |
| 3:3FTCA | 2.0 | U | 1 | 5.0 | 2.0 | 0.60 | ng/L | 08/27/2024 0143 |
| PFTeDA | 0.80 | U | 1 | 1.0 | 0.80 | 0.27 | ng/L | 08/27/2024 0143 |
| PFTrDA | 0.40 | U | 1 | 1.0 | 0.40 | 0.19 | ng/L | 08/27/2024 0143 |
| PFUnA | 0.80 | U | 1 | 1.0 | 0.80 | 0.25 | ng/L | 08/27/2024 0143 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 86 | 40-200 |
| 13C2-6:2FTS | | 93 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - MB

Sample ID: ZQ16856-001
Batch: 16856
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/23/2024 1526

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 84 | 40-300 |
| 13C2-PFDoA | | 74 | 10-130 |
| 13C2-PFTeDA | | 74 | 10-130 |
| 13C3-HFPO-DA | | 88 | 40-130 |
| 13C3-PFBS | | 89 | 40-135 |
| 13C3-PFHxS | | 83 | 40-130 |
| 13C4-PFBA | | 90 | 5-130 |
| 13C4-PFHpA | | 93 | 40-130 |
| 13C5-PFHxA | | 87 | 40-130 |
| 13C5-PFPeA | | 90 | 40-130 |
| 13C6-PFDA | | 85 | 40-130 |
| 13C7-PFUnA | | 81 | 30-130 |
| 13C8-PFOA | | 96 | 40-130 |
| 13C8-PFOS | | 80 | 40-130 |
| 13C8-PFOSA | | 81 | 40-130 |
| 13C9-PFNA | | 91 | 40-130 |
| D3-NMeFOSA | | 60 | 10-130 |
| D3-NMeFOSAA | | 71 | 40-170 |
| D5-NEtFOSA | | 62 | 10-130 |
| D5-NEtFOSAA | | 69 | 25-135 |
| D7-NMeFOSE | | 76 | 10-130 |
| D9-NEtFOSE | | 73 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16856-002
Batch: 16856
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/23/2024 1526

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 91 | 82 | | 1 | 91 | 55-160 | 08/27/2024 0152 |
| 9Cl-PF3ONS | 90 | 100 | | 1 | 113 | 70-155 | 08/27/2024 0152 |
| ADONA | 91 | 100 | | 1 | 116 | 65-145 | 08/27/2024 0152 |
| 8:2FTS | 92 | 98 | | 1 | 107 | 60-150 | 08/27/2024 0152 |
| 4:2FTS | 90 | 100 | | 1 | 114 | 70-145 | 08/27/2024 0152 |
| 6:2FTS | 91 | 100 | | 1 | 110 | 65-155 | 08/27/2024 0152 |
| 5:3FTCA | 600 | 700 | | 1 | 117 | 70-135 | 08/27/2024 0152 |
| HFPO-DA | 96 | 96 | | 1 | 100 | 70-140 | 08/27/2024 0152 |
| NEtFOSA | 24 | 26 | | 1 | 108 | 65-145 | 08/27/2024 0152 |
| NEtFOSAA | 24 | 27 | M-03 | 1 | 111 | 70-145 | 08/27/2024 0152 |
| NEtFOSE | 240 | 260 | | 1 | 109 | 70-135 | 08/27/2024 0152 |
| NMeFOSA | 24 | 26 | | 1 | 109 | 60-150 | 08/27/2024 0152 |
| NMeFOSAA | 24 | 25 | | 1 | 103 | 50-140 | 08/27/2024 0152 |
| NMeFOSE | 240 | 260 | | 1 | 109 | 70-145 | 08/27/2024 0152 |
| NFDHA | 48 | 51 | | 1 | 107 | 50-150 | 08/27/2024 0152 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 43 | 50 | | 1 | 118 | 70-140 | 08/27/2024 0152 |
| PFMPA | 48 | 52 | | 1 | 109 | 55-140 | 08/27/2024 0152 |
| PFMBA | 48 | 52 | | 1 | 109 | 60-150 | 08/27/2024 0152 |
| PFBS | 21 | 23 | | 1 | 110 | 60-145 | 08/27/2024 0152 |
| PFBA | 96 | 100 | | 1 | 108 | 70-140 | 08/27/2024 0152 |
| PFDS | 23 | 22 | | 1 | 97 | 60-145 | 08/27/2024 0152 |
| PFDA | 24 | 24 | | 1 | 100 | 70-140 | 08/27/2024 0152 |
| PFDoS | 23 | 19 | | 1 | 84 | 50-145 | 08/27/2024 0152 |
| PFDoA | 24 | 24 | | 1 | 101 | 70-140 | 08/27/2024 0152 |
| PFHpS | 23 | 26 | | 1 | 114 | 70-150 | 08/27/2024 0152 |
| PFHpA | 24 | 26 | | 1 | 110 | 70-150 | 08/27/2024 0152 |
| 7:3FTCA | 600 | 670 | | 1 | 112 | 50-145 | 08/27/2024 0152 |
| PFHxS | 22 | 23 | | 1 | 103 | 65-145 | 08/27/2024 0152 |
| PFHxA | 24 | 27 | | 1 | 111 | 70-145 | 08/27/2024 0152 |
| PFNS | 23 | 26 | | 1 | 111 | 65-145 | 08/27/2024 0152 |
| PFNA | 24 | 29 | | 1 | 122 | 70-150 | 08/27/2024 0152 |
| PFOSA | 24 | 25 | | 1 | 106 | 70-145 | 08/27/2024 0152 |
| PFOS | 22 | 23 | M-03 | 1 | 105 | 55-150 | 08/27/2024 0152 |
| PFOA | 24 | 26 | | 1 | 108 | 70-150 | 08/27/2024 0152 |
| PFPeS | 23 | 24 | | 1 | 107 | 65-140 | 08/27/2024 0152 |
| PFPeA | 48 | 51 | | 1 | 106 | 65-135 | 08/27/2024 0152 |
| 3:3FTCA | 120 | 140 | | 1 | 117 | 65-130 | 08/27/2024 0152 |
| PFTeDA | 24 | 26 | | 1 | 109 | 60-140 | 08/27/2024 0152 |
| PFTrDA | 24 | 24 | | 1 | 99 | 65-140 | 08/27/2024 0152 |
| PFUnA | 24 | 26 | | 1 | 107 | 70-145 | 08/27/2024 0152 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 73 | 40-200 |
| 13C2-6:2FTS | | 72 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16856-002
Batch: 16856
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/23/2024 1526

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 70 | 40-300 |
| 13C2-PFDoA | | 60 | 10-130 |
| 13C2-PFTeDA | | 54 | 10-130 |
| 13C3-HFPO-DA | | 75 | 40-130 |
| 13C3-PFBS | | 77 | 40-135 |
| 13C3-PFHxS | | 78 | 40-130 |
| 13C4-PFBA | | 78 | 5-130 |
| 13C4-PFHpA | | 81 | 40-130 |
| 13C5-PFHxA | | 78 | 40-130 |
| 13C5-PFPeA | | 80 | 40-130 |
| 13C6-PFDA | | 76 | 40-130 |
| 13C7-PFUnA | | 69 | 30-130 |
| 13C8-PFOA | | 76 | 40-130 |
| 13C8-PFOS | | 73 | 40-130 |
| 13C8-PFOSA | | 72 | 40-130 |
| 13C9-PFNA | | 71 | 40-130 |
| D3-NMeFOSA | | 49 | 10-130 |
| D3-NMeFOSAA | | 71 | 40-170 |
| D5-NEtFOSA | | 50 | 10-130 |
| D5-NEtFOSAA | | 61 | 25-135 |
| D7-NMeFOSE | | 64 | 10-130 |
| D9-NEtFOSE | | 63 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16856-102
Batch: 16856
Analytical Method: 1633
Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/23/2024 1526

| Parameter | Spike Amount (ng/L) | Result (ng/L) | Q | Dil | % Rec | %Rec Limit | Analysis Date |
|---|---|---|---|---|---|---|---|
| 11Cl-PF3OUdS | 7.6 | 8.4 | | 1 | 111 | 55-160 | 08/27/2024 0201 |
| 9Cl-PF3ONS | 7.5 | 9.7 | | 1 | 130 | 70-155 | 08/27/2024 0201 |
| ADONA | 7.6 | 9.7 | | 1 | 129 | 65-145 | 08/27/2024 0201 |
| 8:2FTS | 7.7 | 9.6 | M-03 | 1 | 126 | 60-150 | 08/27/2024 0201 |
| 4:2FTS | 7.5 | 8.7 | | 1 | 117 | 70-145 | 08/27/2024 0201 |
| 6:2FTS | 7.6 | 10 | | 1 | 135 | 65-155 | 08/27/2024 0201 |
| 5:3FTCA | 50 | 63 | | 1 | 125 | 70-135 | 08/27/2024 0201 |
| HFPO-DA | 8.0 | 9.4 | M-03 | 1 | 118 | 70-140 | 08/27/2024 0201 |
| NEtFOSA | 2.0 | 2.4 | M-03 | 1 | 118 | 65-145 | 08/27/2024 0201 |
| NEtFOSAA | 2.0 | 2.5 | M-03 | 1 | 125 | 70-145 | 08/27/2024 0201 |
| NEtFOSE | 20 | 23 | | 1 | 116 | 70-135 | 08/27/2024 0201 |
| NMeFOSA | 2.0 | 2.2 | M-03 | 1 | 112 | 60-150 | 08/27/2024 0201 |
| NMeFOSAA | 2.0 | 1.9 | M-03 | 1 | 97 | 50-140 | 08/27/2024 0201 |
| NMeFOSE | 20 | 22 | | 1 | 112 | 70-145 | 08/27/2024 0201 |
| NFDHA | 4.0 | 4.4 | M-03 | 1 | 110 | 50-150 | 08/27/2024 0201 |
| 2-ethoxyethane)sulfonic acid (PFEESA | 3.6 | 4.6 | | 1 | 129 | 70-140 | 08/27/2024 0201 |
| PFMPA | 4.0 | 4.4 | | 1 | 110 | 55-140 | 08/27/2024 0201 |
| PFMBA | 4.0 | 4.3 | | 1 | 107 | 60-150 | 08/27/2024 0201 |
| PFBS | 1.8 | 2.0 | | 1 | 112 | 60-145 | 08/27/2024 0201 |
| PFBA | 8.0 | 9.4 | | 1 | 118 | 70-140 | 08/27/2024 0201 |
| PFDS | 1.9 | 2.0 | | 1 | 102 | 60-145 | 08/27/2024 0201 |
| PFDA | 2.0 | 2.5 | | 1 | 124 | 70-140 | 08/27/2024 0201 |
| PFDoS | 1.9 | 1.7 | | 1 | 85 | 50-145 | 08/27/2024 0201 |
| PFDoA | 2.0 | 2.2 | M-03 | 1 | 109 | 70-140 | 08/27/2024 0201 |
| PFHpS | 1.9 | 2.1 | M-03 | 1 | 112 | 70-150 | 08/27/2024 0201 |
| PFHpA | 2.0 | 2.4 | | 1 | 118 | 70-150 | 08/27/2024 0201 |
| 7:3FTCA | 50 | 58 | | 1 | 115 | 50-145 | 08/27/2024 0201 |
| PFHxS | 1.8 | 2.0 | | 1 | 109 | 65-145 | 08/27/2024 0201 |
| PFHxA | 2.0 | 2.4 | M-03 | 1 | 120 | 70-145 | 08/27/2024 0201 |
| PFNS | 1.9 | 2.2 | | 1 | 114 | 65-145 | 08/27/2024 0201 |
| PFNA | 2.0 | 2.0 | M-03 | 1 | 102 | 70-150 | 08/27/2024 0201 |
| PFOSA | 2.0 | 2.3 | | 1 | 116 | 70-145 | 08/27/2024 0201 |
| PFOS | 1.9 | 2.0 | | 1 | 108 | 55-150 | 08/27/2024 0201 |
| PFOA | 2.0 | 2.8 | M-03 | 1 | 138 | 70-150 | 08/27/2024 0201 |
| PFPeS | 1.9 | 2.2 | | 1 | 120 | 65-140 | 08/27/2024 0201 |
| PFPeA | 4.0 | 4.6 | | 1 | 114 | 65-135 | 08/27/2024 0201 |
| 3:3FTCA | 10 | 12 | | 1 | 116 | 65-130 | 08/27/2024 0201 |
| PFTeDA | 2.0 | 2.2 | | 1 | 111 | 60-140 | 08/27/2024 0201 |
| PFTrDA | 2.0 | 2.2 | | 1 | 112 | 65-140 | 08/27/2024 0201 |
| PFUnA | 2.0 | 2.3 | | 1 | 117 | 70-145 | 08/27/2024 0201 |

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-4:2FTS | | 79 | 40-200 |
| 13C2-6:2FTS | | 74 | 40-200 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# PFAS by LC/MS/MS - LCS

Sample ID: ZQ16856-102
Batch: 16856
Analytical Method: 1633

Matrix: Aqueous
Prep Method: 1633
Prep Date: 08/23/2024 1526

| Surrogate | Q | % Rec | Acceptance Limit |
|---|---|---|---|
| 13C2-8:2FTS | | 61 | 40-300 |
| 13C2-PFDoA | | 63 | 10-130 |
| 13C2-PFTeDA | | 57 | 10-130 |
| 13C3-HFPO-DA | | 78 | 40-130 |
| 13C3-PFBS | | 79 | 40-135 |
| 13C3-PFHxS | | 80 | 40-130 |
| 13C4-PFBA | | 81 | 5-130 |
| 13C4-PFHpA | | 81 | 40-130 |
| 13C5-PFHxA | | 79 | 40-130 |
| 13C5-PFPeA | | 82 | 40-130 |
| 13C6-PFDA | | 71 | 40-130 |
| 13C7-PFUnA | | 66 | 30-130 |
| 13C8-PFOA | | 77 | 40-130 |
| 13C8-PFOS | | 79 | 40-130 |
| 13C8-PFOSA | | 80 | 40-130 |
| 13C9-PFNA | | 82 | 40-130 |
| D3-NMeFOSA | | 56 | 10-130 |
| D3-NMeFOSAA | | 73 | 40-170 |
| D5-NEtFOSA | | 58 | 10-130 |
| D5-NEtFOSAA | | 67 | 25-135 |
| D7-NMeFOSE | | 71 | 10-130 |
| D9-NEtFOSE | | 68 | 10-130 |

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOD
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-001 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-001 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-001 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-001 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-001 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZG19017-002 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-002 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-002 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-002 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-002 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-002 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-003 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-003 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-003 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-003 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-003 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-003 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-003 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-003 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-003 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-003 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-003 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-003 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZG19017-004 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-004 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-004 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-004 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-004 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-004 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-004 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-004 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-004 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-004 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-004 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-004 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-004 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZG19017-004 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZG19017-004 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZG19017-005 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-005 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-005 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-005 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZG19017-005 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-005 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-005 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-005 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-005 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-005 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-005 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-005 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZG19017-006 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-006 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-006 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-006 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-006 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-006 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-006 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-006 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-006 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZG19017-006 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZG19017-006 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZG19017-006 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZG19017-006 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZG19017-006 | 2 | D3-NMeFOSA | M-03 |
| 1633 | ZG19017-006 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZG19017-006 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZG19017-007 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-007 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-007 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-007 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-007 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-007 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-007 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-007 | 1 | 13C2-4:2FTS | M-03 |
| 1633 | ZG19017-007 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZG19017-007 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZG19017-007 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZG19017-008 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-008 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZG19017-008 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-008 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-008 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-008 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-008 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-008 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-008 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZG19017-008 | 2 | 13C5-PFHxA | M-03 |
| 1633 | ZG19017-008 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZG19017-008 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-008 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZG19017-008 | 2 | D3-NMeFOSA | M-03 |
| 1633 | ZG19017-008 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZG19017-009 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-009 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZG19017-009 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-009 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-009 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-009 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-009 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-009 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-009 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-009 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZG19017-009 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZG19017-009 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZG19017-009 | 2 | 13C4-PFHpA | M-03 |
| 1633 | ZG19017-009 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZG19017-009 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-009 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZG19017-009 | 1 | D5-NEtFOSAA | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-010 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-010 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-010 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-010 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-010 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-010 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-010 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-011 | 1 | Nonafluoro-3,6-dioxaheptanoic acid | M-03 |
| 1633 | ZG19017-011 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-011 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-011 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-011 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-011 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-011 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-011 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-011 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-011 | 1 | D3-NMeFOSAA | M-03 |
| 1633 | ZG19017-012 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-012 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-012 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-012 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-012 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-012 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-012 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-012 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-013 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-013 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZG19017-013 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-013 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-013 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-013 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-013 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-013 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-013 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZG19017-013 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZG19017-013 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZG19017-013 | 2 | 13C2-PFTeDA | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-013 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZG19017-013 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-013 | 2 | 13C8-PFOSA | M-03 |
| 1633 | ZG19017-013 | 2 | D5-NEtFOSA | M-03 |
| 1633 | ZG19017-013 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZG19017-014 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZG19017-014 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-014 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZG19017-014 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-014 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-014 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-014 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-014 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-014 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-014 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-014 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZG19017-014 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZG19017-014 | 1 | 13C6-PFDA | M-03 |
| 1633 | ZG19017-014 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZG19017-014 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZG19017-014 | 2 | 13C8-PFOA | M-03 |
| 1633 | ZG19017-014 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-014 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZG19017-014 | 1 | D5-NEtFOSA | M-03 |
| 1633 | ZG19017-015 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-015 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZG19017-015 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-015 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-015 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-015 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-015 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-015 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-015 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-015 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-015 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-015 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-015 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-015 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-015 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-015 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-015 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-09 |
| 1633 | ZG19017-015 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-015 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-015 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZG19017-015 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZG19017-015 | 2 | 13C3-PFBS | M-03 |
| 1633 | ZG19017-015 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-015 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZG19017-015 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZG19017-015 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-015 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-015 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZG19017-015 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-015 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-015 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-015 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-015 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-015 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-015 | 3 | 13C2-8:2FTS | M-03 |
| 1633 | ZG19017-016 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-016 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-016 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-016 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-016 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-016 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-016 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-016 | 2 | Perfluorobutanoic acid (PFBA) | M-09 |
| 1633 | ZG19017-016 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-09 |
| 1633 | ZG19017-016 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-016 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-016 | 2 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-016 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-016 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-016 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-016 | 2 | Perfluoropentanoic acid (PFPeA) | M-09 |
| 1633 | ZG19017-016 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZG19017-016 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZG19017-016 | 2 | 13C8-PFOA | M-03 |
| 1633 | ZG19017-016 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZG19017-016 | 2 | D5-NEtFOSA | M-03 |
| 1633 | ZG19017-016 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZG19017-016 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-016 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-016 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZG19017-016 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-016 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-016 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-016 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-016 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-016 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-016 | 3 | D5-NEtFOSAA | M-03 |
| 1633 | ZG19017-017 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZG19017-017 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-017 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZG19017-017 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-017 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-017 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-017 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-017 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-017 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-017 | 1 | 13C2-8:2FTS | M-03 |
| 1633 | ZG19017-017 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZG19017-017 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZG19017-017 | 2 | 13C3-PFHxS | M-03 |
| 1633 | ZG19017-017 | 1 | 13C9-PFNA | M-03 |
| 1633 | ZG19017-017 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZG19017-017 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZG19017-018 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-018 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZG19017-018 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-018 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-018 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-018 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-018 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-018 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-018 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-018 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-018 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-018 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZG19017-018 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZG19017-018 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZG19017-018 | 2 | 13C2-PFTeDA | M-03 |
| 1633 | ZG19017-018 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZG19017-018 | 2 | D3-NMeFOSA | M-03 |
| 1633 | ZG19017-019 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-019 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZG19017-019 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-019 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-019 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-019 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-019 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-019 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-019 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-019 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-019 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZG19017-020 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-020 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-020 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZG19017-020 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-020 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-020 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-020 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-020 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-020 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-020 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-020 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-020 | 2 | Perfluorobutanoic acid (PFBA) | M-09 |
| 1633 | ZG19017-020 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-020 | 2 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-020 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-020 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-020 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-020 | 2 | Perfluoropentanoic acid (PFPeA) | M-09 |
| 1633 | ZG19017-020 | 2 | 13C2-6:2FTS | M-03 |
| 1633 | ZG19017-020 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZG19017-020 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-020 | 2 | 13C9-PFNA | M-03 |
| 1633 | ZG19017-020 | 2 | D3-NMeFOSA | M-03 |
| 1633 | ZG19017-020 | 2 | D3-NMeFOSAA | M-03 |
| 1633 | ZG19017-020 | 2 | D5-NEtFOSAA | M-03 |
| 1633 | ZG19017-020 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-020 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-020 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-020 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-020 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZG19017-020 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-020 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-020 | 3 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-020 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-020 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-020 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-020 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-021 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-021 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-021 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZG19017-021 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-021 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-021 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-021 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-021 | 1 | D5-NEtFOSAA | M-03 |
| 1633 | ZG19017-022 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZG19017-022 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-022 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-022 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-022 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-022 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-022 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-022 | 2 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZG19017-022 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-022 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-022 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-022 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-022 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-023 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-023 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-023 | 1 | Perfluorononanesulfonic acid (PFNS) | M-10 |
| 1633 | ZG19017-023 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-023 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-023 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-023 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-023 | 1 | D5-NEtFOSAA | M-03 |
| 1633 | ZG19017-023 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-023 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-023 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-023 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-023 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-023 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-023 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-023 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZG19017-023 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-023 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-023 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-023 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-023 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-023 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-023 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-023 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-024 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-024 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-024 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZG19017-024 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-024 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-024 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-024 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-024 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZG19017-024 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-024 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-024 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-024 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-024 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-024 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-024 | 2 | 13C3-PFBS | M-03 |
| 1633 | ZG19017-024 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-024 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-024 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-024 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZG19017-024 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-024 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-024 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-024 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-024 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-024 | 3 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-025 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-025 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZG19017-025 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-025 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-025 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-025 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-025 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-025 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-025 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-025 | 2 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZG19017-025 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-025 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-025 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-025 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-025 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-025 | 2 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-025 | 2 | 13C5-PFHxA | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-025 | 3 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZG19017-025 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-025 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-025 | 3 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-025 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZG19017-025 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-025 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-025 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-025 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-025 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-025 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-025 | 3 | Perfluoropentanoic acid (PFPeA) | M-10 |
| 1633 | ZG19017-026 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-026 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-026 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-026 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-026 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-026 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-027 | 1 | Perfluoro-3-methoxypropanoic acid | M-03 |
| 1633 | ZG19017-027 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZG19017-027 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-027 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZG19017-027 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-027 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-027 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-027 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-027 | 1 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-027 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-027 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-027 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-027 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-027 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-027 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-027 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZG19017-027 | 2 | 13C2-8:2FTS | M-03 |
| 1633 | ZG19017-027 | 2 | 13C7-PFUnA | M-03 |
| 1633 | ZG19017-027 | 3 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-027 | 3 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-027 | 3 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-027 | 3 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZG19017-027 | 3 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-027 | 3 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-027 | 3 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-027 | 3 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-027 | 3 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-027 | 3 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-028 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-028 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-028 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-028 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-028 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-028 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-028 | 2 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-028 | 2 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZG19017-028 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-028 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-028 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-028 | 2 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-029 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-029 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-029 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-029 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-029 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-029 | 2 | 13C2-4:2FTS | M-03 |
| 1633 | ZG19017-029 | 2 | 13C2-PFDoA | M-03 |
| 1633 | ZG19017-029 | 2 | 13C6-PFDA | M-03 |
| 1633 | ZG19017-029 | 2 | 13C8-PFOS | M-03 |
| 1633 | ZG19017-029 | 2 | D3-NMeFOSA | M-03 |
| 1633 | ZG19017-030 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-030 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-030 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-030 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-030 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-030 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZG19017-030 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZG19017-030 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZG19017-030 | 1 | 13C2-PFTeDA | M-03 |
| 1633 | ZG19017-030 | 1 | D5-NEtFOSAA | M-03 |
| 1633 | ZG19017-030 | 2 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZG19017-030 | 2 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-030 | 2 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZG19017-030 | 2 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-030 | 2 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-030 | 2 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-030 | 2 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-030 | 2 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-031 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZG19017-031 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-031 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-031 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-031 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-031 | 1 | 13C2-6:2FTS | M-03 |
| 1633 | ZG19017-031 | 1 | D5-NEtFOSA | M-03 |
| 1633 | ZQ15907-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ15907-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ15907-102 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ15907-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ15907-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ15907-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZQ15907-102 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZQ15907-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ15907-001 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ15907-102 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZQ15907-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ15907-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ15907-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ15907-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ15907-102 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ15907-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ15907-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ16603-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ16603-102 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZQ16603-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | ZQ16603-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ16603-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16603-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorododecanesulfonic acid (PFDoS) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorononanesulfonic acid (PFNS) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ16603-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ16603-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ16603-002 | 1 | 13C2-4:2FTS | M-03 |
| 1633 | ZQ15908-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ15908-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ15908-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ15908-102 | 1 | N-ethyl | M-03 |
| 1633 | ZG19017-018MS | 1 | N-ethyl | M-03 |
| 1633 | ZG19017-018MD | 1 | N-ethyl | M-03 |
| 1633 | ZQ15908-102 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ15908-102 | 1 | N-methyl | M-03 |
| 1633 | ZG19017-018MS | 1 | N-methyl | M-03 |
| 1633 | ZG19017-018MD | 1 | N-methyl | M-03 |
| 1633 | ZQ15908-102 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZQ15908-102 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | ZQ15908-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ15908-102 | 1 | Perfluorododecanesulfonic acid (PFDoS) | M-03 |
| 1633 | ZQ15908-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZG19017-018MS | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZG19017-018MD | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ15908-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ15908-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZG19017-018MS | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZG19017-018MD | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ15908-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ15908-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-018MS | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZG19017-018MD | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ15908-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-018MS | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZG19017-018MD | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ15908-102 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZQ15908-102 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ15908-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZG19017-018MD | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ16856-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ16856-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | ZQ16856-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ16856-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16856-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16856-102 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ16856-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ16856-102 | 1 | Nonafluoro-3,6-dioxaheptanoic acid | M-03 |
| 1633 | ZQ16856-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ16856-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ16856-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ16856-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ16856-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16856-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ16352-102 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZQ16352-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | ZQ16352-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16352-002 | 1 | N-methyl | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ16352-102 | 1 | Nonafluoro-3,6-dioxaheptanoic acid | M-03 |
| 1633 | ZQ16352-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ16352-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ16352-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ16352-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16352-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16352-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ16352-102 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZQ16352-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ16000-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ16000-102 | 1 | 1H,1H,2H,2H-Perfluorohexane sulfonic | M-03 |
| 1633 | ZQ16000-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | ZQ16000-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16000-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16000-102 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ16000-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ16000-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ16000-102 | 1 | Nonafluoro-3,6-dioxaheptanoic acid | M-03 |
| 1633 | ZQ16000-102 | 1 | Perfluoro-3-methoxypropanoic acid | M-03 |
| 1633 | ZQ16000-102 | 1 | Perfluoro-4-methoxybutanoic acid | M-03 |
| 1633 | ZQ16000-001 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZQ16000-002 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZQ16000-102 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZQ16000-102 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | ZQ16000-102 | 1 | 3-Perfluoroheptyl propanoic acid | M-03 |
| 1633 | ZQ16000-001 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16000-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16000-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16000-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ16000-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ16000-001 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ16000-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16000-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16000-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16000-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ16000-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ16000-001 | 1 | 13C2-8:2FTS | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ16118-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ16118-102 | 1 | 1H,1H,2H,2H-Perfluorohexane sulfonic | M-03 |
| 1633 | ZQ16118-102 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZQ16118-102 | 1 | 2H,2H,3H,3H-Perfluorooctanoic acid | M-03 |
| 1633 | ZQ16118-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | ZQ16118-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16118-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16118-001 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16118-102 | 1 | N-methyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ16118-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ16118-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ16118-001 | 1 | N-methyl | M-03 |
| 1633 | ZQ16118-102 | 1 | Nonafluoro-3,6-dioxaheptanoic acid | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluoro(2-ethoxyethane)sulfonic acid | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluoro-3-methoxypropanoic acid | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluoro-4-methoxybutanoic acid | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZQ16118-002 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZQ16118-001 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16118-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ16118-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16118-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZQ16118-102 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ16118-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ16518-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ16518-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ16518-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16518-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ16518-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ16518-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ16518-102 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZQ16518-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16518-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ16518-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ16518-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16518-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16518-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ16518-102 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZQ16518-002 | 1 | 13C2-PFDoA | M-03 |
| 1633 | ZQ16172-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ16172-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16172-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ16172-102 | 1 | Nonafluoro-3,6-dioxaheptanoic acid | M-03 |
| 1633 | ZQ16172-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ16172-102 | 1 | Perfluorododecanesulfonic acid (PFDoS) | M-03 |
| 1633 | ZQ16172-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ16172-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ16172-102 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ16172-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16172-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16172-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16172-102 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZQ16172-102 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZQ16172-102 | 1 | Perfluorotetradecanoic acid (PFTeDA) | M-03 |
| 1633 | ZQ16172-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ16001-001 | 1 | 1H,1H,2H,2H-Perfluorooctane sulfonic | M-03 |
| 1633 | ZQ16001-102 | 1 | 2H,2H,3H,3H-Perfluorooctanoic acid | M-03 |
| 1633 | ZQ16001-102 | 1 | Hexafluoropropylene oxide dimer acid | M-03 |
| 1633 | ZQ16001-102 | 1 | N-ethyl perfluorooctanesulfonamide | M-03 |
| 1633 | ZQ16001-002 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16001-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16001-002 | 1 | N-methyl | M-03 |
| 1633 | ZQ16001-102 | 1 | N-methyl | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ16001-002 | 1 | Perfluoro-3-methoxypropanoic acid | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluoro-3-methoxypropanoic acid | M-03 |
| 1633 | ZQ16001-002 | 1 | Perfluoro-4-methoxybutanoic acid | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZQ16001-002 | 1 | Perfluorodecanesulfonic acid (PFDS) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluorododecanesulfonic acid (PFDoS) | M-03 |
| 1633 | ZQ16001-002 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZQ16001-102 | 1 | 3-Perfluoroheptyl propanoic acid | M-03 |
| 1633 | ZQ16001-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluorohexanoic acid (PFHxA) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ16001-002 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ16001-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16001-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluoropentanesulfonic acid (PFPeS) | M-03 |
| 1633 | ZQ16001-002 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluoropentanoic acid (PFPeA) | M-03 |
| 1633 | ZQ16001-102 | 1 | 3-Perfluoropropyl propanoic acid | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ16001-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |
| 1633 | ZQ16001-002 | 1 | 13C2-6:2FTS | M-03 |
| 1633 | ZQ16574-102 | 1 | 1H,1H,2H,2H-Perfluorodecane sulfonic | M-03 |
| 1633 | ZQ16574-102 | 1 | 2H,2H,3H,3H-Perfluorooctanoic acid | M-03 |
| 1633 | ZQ16574-102 | 1 | N-ethyl | M-03 |
| 1633 | ZQ16574-102 | 1 | N-methyl | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluoro-3-methoxypropanoic acid | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluorobutanesulfonic acid (PFBS) | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluorobutanoic acid (PFBA) | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluorodecanoic acid (PFDA) | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluorododecanoic acid (PFDoA) | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluoroheptanesulfonic acid (PFHpS) | M-03 |

# Manual Integration Summary

## Arcadis U.S., Inc.

Lot Number: ZG19017

Project Name: ESTCP Vertebrae

Project Number: 30027244.00004

Where applicable, analytes for which manual integration occurred have been flagged with the following:

| Qualifier | Technical Justification | Qualifier | Technical Justification | Qualifier | Technical Justification |
|---|---|---|---|---|---|
| M-01 | Split peak | M-07 | Low fit | M-13 | Error |
| M-02 | Peak tailing | M-08 | Peak not found | M-14 | Baseline |
| M-03 | Incorrect auto integration | M-09 | Analyte not Identified by the Data System | M-15 | Other |
| M-04 | Poor chromatography | M-10 | Analyte misidentified by the Data System | M-16 | Retention time shift |
| M-05 | Manually assigned peak | M-11 | Invalid integration | M-17 | Shouldering |
| M-06 | Wrong isomer | M-12 | Wrong peak | | |

A summary of instances where manual integration occurred is included below:

| Method | Sample | Run Number | Parameter | Qualifier |
|---|---|---|---|---|
| 1633 | ZQ16574-102 | 1 | Perfluoroheptanoic acid (PFHpA) | M-03 |
| 1633 | ZQ16574-102 | 1 | 3-Perfluoroheptyl propanoic acid | M-03 |
| 1633 | ZQ16574-002 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluorohexanesulfonic acid (PFHxS) | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluorononanoic acid (PFNA) | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluorooctanesulfonamide (PFOSA) | M-03 |
| 1633 | ZQ16574-001 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16574-002 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluorooctanesulfonic acid (PFOS) | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluorooctanoic acid (PFOA) | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluorotridecanoic acid (PFTrDA) | M-03 |
| 1633 | ZQ16574-102 | 1 | Perfluoroundecanoic acid (PFUnA) | M-03 |

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

# Chain of Custody
# and
# Miscellaneous Documents

Pace® Location Requested (City/State):

# CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields

LAB USE ONLY- Affix Workorder/Log

ZG19017

Scan QR Code for instructions

KE92

Company Name: Arcadis

Report Address: 28550 Cabot Drive, Suite 500 Novi, MI 48377

Customer Project #: 30027244.00004

Project Name: ESTCP Vertebrae

Site Collection Info/Facility ID (as applicable):

Contact/Report To: Cameron Stewart

Phone #: 618-237-7488

E-Mail: Cameron.Stewart@arcadis.com

Cc E-Mail: Jesse.Wright@arcadis.com; Craig.Divine@arcadis.com

Invoice To: Cameron.Stewart@arcadis.com

Invoice E-Mail:

Purchase Order # (if applicable):

Quote #:

Country / State origin of sample(s):

Time Zone Collected: [ ] AK [ ] PT [ ] MT [ ] CT [X] ET

Data Deliverables: [X] Level II [ ] Level III [ ] Level IV [ ] EQUIS [ ] Other

Regulatory Program (DW, RCRA, etc.) as applicable:

Reportable [ ] Yes [ ] No

Rush (Pre-approval required): [ ] Same Day [ ] 1 Day [ ] 2 Day [ ] 3 Day [ ] Other

Date Results Requested: Standard TAT

CW PWSID # or WW Permit # as applicable:

Field Filtered (if applicable): [ ] Yes [X] No

Analysis:

Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Waste Water (WW), Product (P), Soil/Solid (SS), Oil (OL), Wipe (WP), Tissue (TS), Air (A), Vapor (V), Surface Water (SW), Sediment (SED), Sludge (SL), Caulk (CK), Leachate (LE), Biyolic (BY), Other (OT)

| Customer Sample ID | Matrix* | Comp / Grab | Composite Start Date | Composite Start Time | Collected or Composite End Date | Collected or Composite End Time | # Cont. | Res. Chlorine Results | Res. Chlorine Units | PFAS - 1633 | Sample Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-D-MS_07152024 | GW | G | — | — | 7/15/24 | 1325 | 3 | | | X | |
| VRTB-D-06_07152024 | GW | G | — | — | 7/15/24 | 1440 | 3 | | | X | |
| VRTB-D-R7_07152024 | GW | G | — | — | 7/15/24 | 1535 | 3 | | | X | |
| VRTB-D-P8_07152024 | GW | G | — | — | 7/15/24 | 1625 | 3 | | | X | |
| VRTB-S-B1_07152024 | GW | G | — | — | 7/15/24 | 1720 | 3 | | | X | |
| VRTB-S-S2_07152024 | GW | G | — | — | 7/15/24 | 1810 | 3 | | | X | |
| VRTB-S-Y3_07152024 | GW | G | — | — | 7/15/24 | 1910 | 3 | | | X | |
| VRTB-S-G4_07152024 | GW | G | — | — | 7/15/24 | 1955 | 3 | | | X | |
| VRTB-D-B1_07162024 | GW | G | — | — | 7/16/24 | 1105 | 3 | | | X | |
| VRTB-D-S2_07162024 | GW | G | — | — | 7/16/24 | 1150 | 3 | | | X | |

Specify Container Size **

Identify Container Preservative Type***

Analysis Requested

**Container Size: [1] 1L, [2] 500mL, [3] 250mL, [4] 125mL, [5] 100mL, [6] 40mL vial, [7] EnCore, [8] TerraCore, [9] 90mL, [10] Other

*** Preservative Types: [1] None, [2] HNO3, [3] H2SO4, [4] HCl, [5] NaOH, [6] Zn Acetate, [7] NaHSO4, [8] Sod. Thiosulfate, [9] Ascorbic Acid, [10] MeOH, [11] Other

Lab Use Only: Proj. Mgr: Acct/Num. / Client ID: Table #: Profile / Template: Prelog / Bottle Ord. ID:

Preservation non-conformance identified for sample.

Additional Instructions from Pace®:

Collected by: (Printed Name) Austin Westhuis

Signature

Customer Remarks / Special Conditions / Possible Hazards:

# Coolers: 1 Thermometer ID: Y Correction Factor (°C): 0 Uncorr. Temp. (°C): 1.7 1.3 1.1 1.5 Corrected Temp. (°C): 1.7 1.3 1.1 1.5 On Ice: Y

| Relinquished by/Company: (Signature) | Date/Time: | Received by/Company: (Signature) | Date/Time: | Sealing Number: |
|---|---|---|---|---|
| Austin Westhuis/Arcadis | | FedEx | | |
| Relinquished by/Company: (Signature) | Date/Time: | Received by/Company: (Signature) | Date/Time: | Delivered by: [ ] In-Person [ ] Courier |
| Relinquished by/Company: (Signature) | Date/Time: | Received by/Company: (Signature) | Date/Time: | [ ] FedEx [ ] UPS [ ] Other |
| Relinquished by/Company: (Signature) FEDEX | Date/Time: 7/19/24 1100 | Received by/Company: (Signature) | Date/Time: 7/19/24 1100 | Page: 1 of 4 |

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace® Terms and Conditions found at https://www.pacelabs.com/resource-library/resource/pace-terms-and-conditions/

ENV-FRM-CORC-0019_v02_110123

Pace Analytical Services, LLC (formerly Shealy Environmental Services, Inc.)
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Pace® Location Requested (City/State):

# CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields

LAB USE ONLY- Affix Workorder/Login Label Here

ZG19017

Scan QR Code for instruc

KE62

| | |
|---|---|
| Company Name: Arcadis | Contact/Report To: Cameron Stewart |
| Project Address: 28550 Cabot Drive, Suite 500 Novi, MI 48377 | Phone #: 618-237-7488 |
| | E-Mail: Cameron.Stewart@arcadis.com |
| Customer Project #: 30027244.00004 | Cc E-Mail: Jesse.Wright@arcadis.com Craig.Divine@arcadis.com |
| Project Name: ESTCP Vertebrae | Invoice To: Cameron.Stewart@arcadis.com |
| Site Collection Info/Facility ID (as applicable): | Invoice E-Mail: |
| | Purchase Order # (if applicable): |
| | Quote #: |
| Time Zone Collected: [ ] AK [ ] PT [ ] MT [ ] CT [X] ET | Country / State origin of sample(s): |
| Data Deliverables: [X] Level II [ ] Level III [ ] Level IV [ ] EQUIS [ ] Other | Regulatory Program (DW, RCRA, etc.) as applicable: Reportable [ ] Yes [ ] No |
| | Rush (Pre-approval required): [ ] Same Day [ ] 1 Day [ ] 2 Day [ ] 3 Day [ ] Other |
| | DW PWSID # or WW Permit # as applicable: |
| | Date Results Requested: Standard TAT |
| | Field Filtered (if applicable): [ ] Yes [X] No |
| | Analysis: |

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Waste Water (WW), Product (P), Soil/Solid (SS), Oil (OL), Wipe (WP), Tissue (TS), Bioassay (B), Vapor (V), Surface Water (SW), Sediment (SED), Sludge (SL), Caulk (CK), Leachate (LL), Biosolid (BS), Other (OT)

| Customer Sample ID | Matrix * | Comp / Grab | Composite Start Date | Composite Start Time | Collected or Composite End Date | Collected or Composite End Time | # Cont. | Res. Chlorine Results | Res. Chlorine Units | PFAS-1633 | Sample Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-D-Y3_07162024 | GW | G | — | — | 7/16/24 | 1255 | 3 | | | X | |
| VRTB-D-64_07162024 | GW | G | — | — | 7/16/24 | 1355 | 3 | | | X | |
| VRTB-S-M5_07162024 | GW | G | — | — | 7/16/24 | 1505 | 3 | | | X | |
| VRTB-S-06_07162024 | GW | G | — | — | 7/16/24 | 1626 | 3 | | | X | |
| VRTB-S-R7_07162024 | GW | G | — | — | 7/16/24 | 1735 | 3 | | | X | |
| VRTB-S-P8_07162024 | GW | G | — | — | 7/16/24 | 1840 | 3 | | | X | |
| VRTB-L-B1_07172024 | GW | G | — | — | 7/17/24 | 1000 | 3 | | | X | |
| VRTB-L-52_07172024 | GW | G | — | — | 7/17/24 | 1105 | 9 | | | X | MS/MSD |
| VRTB-L-Y3_07172024 | GW | G | — | — | 7/17/24 | 1205 | 3 | | | X | |
| DUP-01_07162024 | GW | G | — | — | 7/16/24 | — | 3 | | | X | |

Specify Container Size **

Identify Container Preservative Type***

Analysis Requested

**Container Size: (1) 1L, (2) 500mL, (3) 250mL, (4) 125mL, (5) 100mL, (6) 40mL vial, (7) En Core, (8) TerraCore, (9) 90mL, (99) Other

*** Preservative Types: (1) None, (2) HNO3, (3) H2SO4, (4) HCl, (5) NaOH, (6) Zn Acetate, (7) NaHSO4, (8) Sod. Thiosulfate, (9) Ascorbic Acid, (10) MeOH, (11) Other

Lab Use Only

Proj. Mgr:

Account # / Client ID:

Table #:

Profile / Template:

Prelog / Bottle Ord. ID:

Preservation non-conformance identified for sample:

Additional Instructions from Pace®:

Collected By: (Printed Name) Austin Westhuis

Signature:

Customer Remarks / Special Conditions / Possible Hazards:

| # Coolers | Thermometer ID: | Correction Factor (°C): | Obs. Temp (°C) | Corrected Temp (°C) | Cooler |
|---|---|---|---|---|---|
| 1 | 8 | B | 1.2, 3.1, 1.5 | | 7 |

| | | | | |
|---|---|---|---|---|
| Relinquished by/Company: (Signature) Austin Westhuis / Arcadis | Date/Time: | Received by/Company: (Signature) FedEx | Date/Time: | Tracking Number: |
| Relinquished by/Company: (Signature) | Date/Time: | Received by/Company: (Signature) | Date/Time: | Delivered by: [ ] In Person [ ] Courier [ ] FedEx [ ] UPS [ ] Other |
| Relinquished by/Company: (Signature) | Date/Time: | Received by/Company: (Signature) | Date/Time: | |
| Relinquished by/Company: (Signature) FedEx | Date/Time: 7/17/24 11:00 | Received by/Company: (Signature) | Date/Time: 7/18/24 1100 | Page: 2 of 4 |

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace® Terms and Conditions found at https://www.pacelabs.com/resource-library/resource/pace-terms-and-conditions/

ENV-FRM-CORO-0019_v03_110125 ©

Pace Analytical Services, LLC (formerly Shealy Environmental Services, Inc.)
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Pace® Location Requested (City/State):

# CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields

LAB USE ONLY- Affix Workorder/Log

ZG19017

Scan QR Code for Instructi

KES2

| | |
|---|---|
| Company Name: Arcadis | Contact/Report To: Cameron Stewart |
| Street Address: 28550 Cabot Drive, Suite 500 Novi, MI 48377 | Phone #: 618-237-7188 |
| | E-Mail: Cameron.Stewart@arcadis.com |
| | Cc E-Mail: Jesse.Wright@arcadis.com Craig.Divine@arcadis.com |
| Customer Project #: 30027244.00004 | Invoice To: Cameron.Stewart@arcadis.com |
| Project Name: ESTCP Vertebrae | Invoice E-Mail: |
| Site Collection Info/Facility ID (as applicable): | Purchase Order # (if applicable): |
| | Quote #: |

Time Zone Collected: [ ] AK [ ] PT [ ] MT [ ] CT [X] ET

County / State origin of sample(s):

Data Deliverables: [X] Level II [ ] Level III [ ] Level IV [ ] EQUIS [ ] Other

Regulatory Program (DW, RCRA, etc.) as applicable: Reportable [ ] Yes [ ] No

Rush (Pre-approval required): [ ] Same Day [ ] 1 Day [ ] 2 Day [ ] 3 Day [ ] Other

DW PWSID # or WW Permit # as applicable:

Date Results Requested: Standard TAT

Field Filtered (if applicable): [ ] Yes [X] No

Analysis:

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Waste Water (WW), Product (P), Soil/Solid (SS), Oil (OL), Wipe (WP), Tissue (TS), Sloassay (B), Vapor (V), Surface Water (SW), Sediment (SED), Sludge (SL), Caulk (CK), Leachate (LL), Biosolid (BS), Other (OT)

| Customer Sample ID | Matrix * | Comp / Grab | Composite Start Date | Composite Start Time | Collected or Composite End Date | Collected or Composite End Time | # Cont. | Res. Chlorine Results | Res. Chlorine Units | PFAS - 16833 | Sample Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VRTB-L-64_07172024 | GW | G | — | — | 7/17/24 | 1805 | 3 | | | X | |
| VRTB-L-M5_07172024 | GW | G | — | — | 7/17/24 | 1455 | 3 | | | X | |
| VRTB-L-06_07172024 | GW | G | — | — | 7/17/24 | 1520 | 3 | | | X | |
| VRTB-L-P7_07172024 | GW | G | — | — | 7/17/24 | 1615 | 3 | | | X | |
| VRTB-L-BB8_07172024 | GW | G | — | — | 7/17/24 | 1715 | 3 | | | X | |
| CMT-VRTB-01_1_07182024 | GW | G | — | — | 7/18/24 | 0915 | 3 | | | X | |
| CMT-VRTB-01_2_07182024 | GW | G | — | — | 7/18/24 | 1005 | 3 | | | X | |
| CMT-VRTB-01_3_07182024 | GW | G | — | — | 7/18/24 | 1040 | 3 | | | X | |
| CMT-VRTB-01_4_07182024 | GW | G | — | — | 7/18/24 | 1120 | 3 | | | X | |
| DUP-02_07172024 | GW | G | — | — | 7/17/24 | — | 3 | | | X | |

Specify Container Size **

Identify Container Preservative Type***

**Container Size: (1) 1L, (2) 500 mL, (3) 250mL, (4) 125mL, (5) 100mL, (6) 40mL vial, (7) EnCore, (8) TerraCore, (9) 10mL, (10) Other

*** Preservative Types: (1) None, (2) HNO3, (3) H2SO4, (4) HCl, (5) NaOH, (6) Zn Acetate, (7) NaHSO4, (8) Sod. Thiosulfate, (9) Ascorbic Acid, (10) MeOH, (11) Other

Lab Use Only: Proj. Mgr: / Acct/Num / Client ID: / Table #: / Profile / Template: / Prelog / Bottle Ord. ID:

Preservation (non-conformance identified for sample):

Additional Instructions from Pace®:

Collected By: (Printed Name) Austin Westhuis

Signature:

Customer Remarks / Special Conditions / Possible Hazards:

| # Coolants | Thermometer ID: | Correction Factor (°C) | Cor. Temp (°C) | Corrected Temp (°C) | On Ice |
|---|---|---|---|---|---|
| 1 | 8 | 0 | 1.7 | 1.5 | Y |

| Relinquished by/Company: (Signature) | Date/Time: | Received by/Company: (Signature) | Date/Time: | Cooling Process: |
|---|---|---|---|---|
| Austin Westhuis/Arcadis | 7/18/24 | FedEx | 7/19/24 | |
| Relinquished by/Company: (Signature) | Date/Time: | Received by/Company: (Signature) | Date/Time: | Delivered by: [ ] In-Person [ ] Courier [ ] FedEX [ ] UPS [ ] Other |
| Relinquished by/Company: (Signature) | Date/Time: | Received by/Company: (Signature) | Date/Time: | |
| FEDEX | 7/19/24 1100 | | 7/19/24 1100 | Page: 3 of 4 |

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace® Terms and Conditions found at https://www.pacelabs.com/resource-library/resource/pace-terms-and-conditions/

ENV-FRM-CORC-0019_v02_110123 ©

Pace Analytical Services, LLC (formerly Shealy Environmental Services, Inc.)
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Pace® Location Required (City/State):

# CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields

LAB USE ONLY - Affix Workorder/Login Label Here

ZG19017

Scan QR Code for Instructions

KESZ

Company Name: Arcadis

Project Address: 23550 Cabot Drive, Suite 500 Novi, MI 48377

Customer Project #: 30073244.000004

Project Name: ESTEP Ventilbrace

Site Collection Info/Facility ID (as applicable):

Contact/Report To: Cameron Stewart

Phone #: 618-237-7488

Email: Cameron.Stewart@arcadis.com

Cc Email: Jessie.Wright@arcadis.com Craig.Bayne@arcadis.com

Invoice To: Cameron.Stewart@arcadis.com

Invoice Email:

Purchase Order # (if applicable):

Quote #:

Specify Container Size **

Identify Container Preservative Type***

Analysis Requested

Preservation Non-conformance identified for sample:

Pres. Mgr:

Acct#/Num. / Client ID:

Table #:

Profile / Template:

Prelog / Bottle Cnt. ID:

Sample Comment

Time Zone Collected: [ ] AK [ ] PT [ ] MT [ ] CT [ ] ET

Data Deliverables:

(X) Level II [ ] Level III [ ] Level IV

[ ] EQUIS

[ ] Other

Regulatory Program (DW, RCRA, etc.) as applicable:

Reportable [ ] Yes [ ] No

Rush (Pre-approval required):

[ ] Same Day [ ] 1 Day [ ] 2 Day [ ] 3 Day [ ] Other ____

Date Results Requested: Standard TAT

DW PWSID # or WW Permit # as applicable

Field Filtered (if applicable): [ ] Yes [X] No

Analysis:

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Waste Water (WW), Product (P), Soil/Solid (SS), Oil (OL), Wipe (WP), Tissue (TS), Biossay (B), Vapor (V), Surface Water (SW), Sediment (SD), Sludge (SL), Caulk (CK), Leachate (LE), Asbestos (AS), Other (OT)

| Customer Sample ID | Matrix * | Comp / Grab | Composite Start Date | Composite Start Time | Collected or Composite End Date | Collected or Composite End Time | # Cont. | Res. Chlorine Results | Res. Chlorine Units |
|---|---|---|---|---|---|---|---|---|---|
| CMT-VRTB-01_5_07182024 | GW | G | 7/18/24 | 1155 | 7/18/24 | 1155 | 3 | X | |

Additional Instructions from Pace®

Customer Remarks / Special Conditions / Possible Hazards:

Collected by: Printed Name: Austin Westhues

Signature:

# Coolers: 1

Thermometer ID: T6

Correction Factor (°C): 0

Date/Time: 7/18/24

Tracking Number:

Relinquished by/Company: (Signature) Date/Time: 7/18/24 Received by/Company: (Signature) Fedex

Relinquished by/Company: (Signature) Date/Time: Received by/Company: (Signature)

Relinquished by/Company: (Signature) Date/Time: 7/19/24 1120 Received by/Company: (Signature)

Date/Time: 7/19/24 1520

Document Rev: [ ] In Person [ ] Courier [ ] FedEx [ ] UPS [ ] Other

Page: 4 of 4

ENV-FRM-CORO-0019_v02_110123©

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace® Terms and Conditions found at: https://www.pacelabs.com/resource-library/resources/pace-terms-and-conditions/

DC#_Title: ENV-FRM-WCOL-0286 v02_Samples Receipt Checklist (SRC)
Effective Date: 8/2/2022

# Sample Receipt Checklist (SRC)

Client: ARCADIS  Cooler Inspected by/date: CDR / 07/19/24  Lot #: 761907

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | | 1. Were custody seals present on the cooler? |
| ☑ Yes | ☐ No | ☐ NA | 2. If custody seals were present, were they intact and unbroken? |

pH Strip ID: NA  Chlorine Strip ID: NA  Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt  %Solid Snap-Cup ID: NA

1.5 / 1.5 °C  3.1 / 3.1 °C  1.7 / 1.7 °C  NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles  IR Gun ID: 8  IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

| | | | |
|---|---|---|---|
| ☑ Yes | ☐ No | ☐ NA | 3. Were all coolers received at or below 6.0°C? If no, was Project Manager notified? PM was Notified by: phone / email / face-to-face (circle one). |
| ☑ Yes | ☐ No | ☐ NA | 4. Is the commercial courier's packing slip attached to this form? |
| ☑ Yes | ☐ No | | 5. Were proper custody procedures (relinquished/received) followed? |
| ☑ Yes | ☐ No | | 6. Were sample IDs listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 7. Was collection date & time listed on the COC and all sample containers? |
| ☑ Yes | ☐ No | | 8. Did all container label information (ID, date, time) agree with the COC? |
| ☑ Yes | ☐ No | | 9. Were tests to be performed listed on the COC? |
| ☑ Yes | ☐ No | | 10. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? |
| ☑ Yes | ☐ No | | 11. Was adequate sample volume available? |
| ☑ Yes | ☐ No | | 12. Were all samples received within ½ the holding time or 48 hours, whichever comes first? |
| ☑ Yes | ☐ No | | 13. Were all samples containers accounted for? (No missing/excess) |
| ☐ Yes | ☐ No | ☑ NA | 14. Were VOA, 8015C and RSK-175 samples free of bubbles >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials? |
| ☐ Yes | ☐ No | ☑ NA | 15. Were all DRO/metals/nutrient samples received at a pH of < 2? |
| ☐ Yes | ☐ No | ☑ NA | 16. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9? |
| ☐ Yes | ☐ No | ☑ NA | 17. Were all applicable $NH_3$/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine? |
| ☑ Yes | ☐ No | ☐ NA | 18. Was the quote number listed on the container label? If yes, Quote # 22514 |

**Sample Preservation** (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA. ☐
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Unique ID: NA.

Comments:

Qualtrax ID: 56360  Pace® Analytical Services, LLC  Page 1 of 1

# APPENDIX D HYDRAULIC TESTING ANALYSIS MEMORANDUM – SLUG TESTING

# Memo

**SUBJECT**
Hydraulic Testing Analysis
Grayling Army Airfield, Michigan

**DATE**
July 27, 2023

**DEPARTMENT**
Environment

**NAME**
Everett Fortner III, PG
Arcadis US

# Introduction

Hydraulic testing activities were performed in 2021 and 2022 at the Grayling Army Airfield located in Crawford County, Michigan to evaluate hydraulic conditions within the shallow groundwater system. The hydraulic response data was further used to evaluate potential skin effects (degree of hydraulic connection) within the Vertebrae™ well screen intervals and to support separate modeling evaluations. Details regarding the hydrogeologic conditions and additional overarching objectives are provided in the main report.

# Methods

The hydraulic testing consisted of localized low stress slug testing by varying methodologies:

- Vertical Aquifer Profiling (VAP) Slug Testing: During vertical aquifer profiling activities and hydraulic profile tool advancement (HPT), testing was completed in September 2021 at select temporary screen intervals with the pneumatic slug testing method. The testing was within three vertical boreholes VAP-VRTB-02/03/04 at four to five intervals each that range in mid-screen depth from 21.3 to 38.3 feet below ground surface (ft bgs).
- Vertical Monitoring Well Slug Testing: Monitoring wells installed based on the VAP profiling results were tested with solid and pneumatic slug testing methods. The testing at five wells have mid-screen depths ranging from approximately 17.5 to 18.5 ft bgs at MW-01S/02S/03 within the shallower portion of the groundwater zone and at approximately 28.5 ft bgs within the deeper portion.
- Horizontal (Vertebrae™) Well Slug Testing: individual isolated horizontal well screens within the shallow (B1, S2, Y3, G4, M5, O6, R7, P8) and deep (B1, S2, Y3, G4, M5, O6, R7, P8) transects were tested using the inflow (falling head) method. Select deep transect intervals (M5, O6, R7, P8) were also testing using the pneumatic slug testing method.

Pneumatic slug tests were completed by pressuring the water column with a manifold system using two differing pressures. The pressurized headspace was estimated with a head space pressure gauge, however, the equalized pressure recorded by the pressure transducer (higher accuracy) was used for the maximum displacement estimate. Solid slug tests were initiated with a PVC rod of known diameter and length. Inflow tests were initiated by inducing a volume of water down the horizontal well casing.

Multiple slug tests were completed at each location. The theoretical displacement was calculated for the solid slug testing and used for comparison to the actual displacements. Due to the gauge inaccuracy with the pneumatic slug tests and the delayed responses for the inflow tests, a comparison of a theoretical to an actual displacement was not feasible.

The water level responses for the slug tests were recorded using a pressure transducer at a fine interval of 0.1 to 0.25 seconds. The recorded data was processed by selecting the maximum displacement or in the cases of initiation noise, the most representative maximum displacement during the test initiation. The recovery displacement data was further processed to improve the efficiency with analysis by retaining the high frequency data for the early time portion and reducing the frequency for the mid to late time portions of each test. The recovery response curves were charted and utilized in a recovery response evaluation to compare the responses that have varying displacements for head dependency (differing recovery time with differing displacement) for the horizontal well tests. The testing data was further screened for quality and usability based on the level of test noise or recovery response. The test(s) with the least amount of noise was used for hydraulic parameter analysis using applicable analytical solutions with AQTESOLV® for Windows© (Duffield, 2007) following guidance in Butler, 2019.

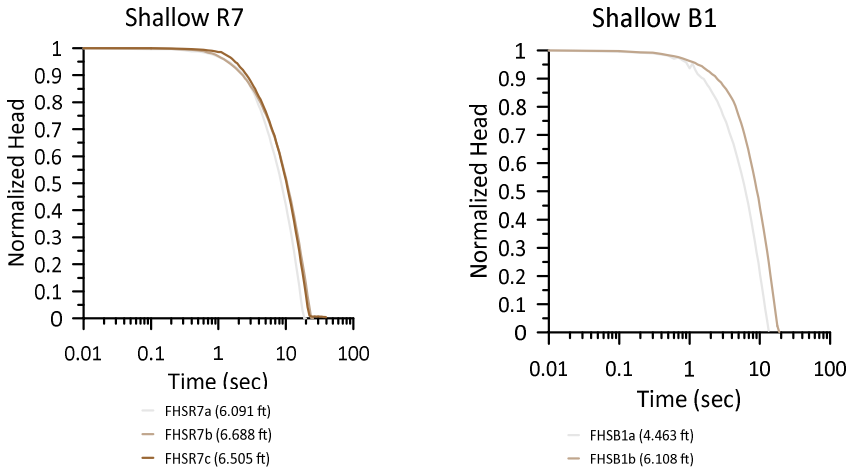
# Recovery Response Evaluation

Comparing normalized recovery responses is a diagnostic tool to verify slug test theory and duplicity of tests; thereby, increasing data quality and evaluation potential of the results (Butler, 2019). The success of low stress hydraulic testing is directly related to the well screen degree of hydraulic connection with the groundwater zone. When hydraulic communication is diminished by well design characteristics or groundwater zone damage caused by drilling methodology that is not mitigated by some degree with development, the hydraulic response is affected. This local diminished hydraulic communication is referred to as a skin effect.

Duplicate slug tests with similar or varied head displacement should approximately coincide in recovery response. The repeat slug test data for the horizontal well screens tested are summarized in a series of normalized displacement charts provided in **Attachment 1**. The testing descriptions are abbreviated as FH (falling head – inflow test) or RH (rising head – pneumatic).

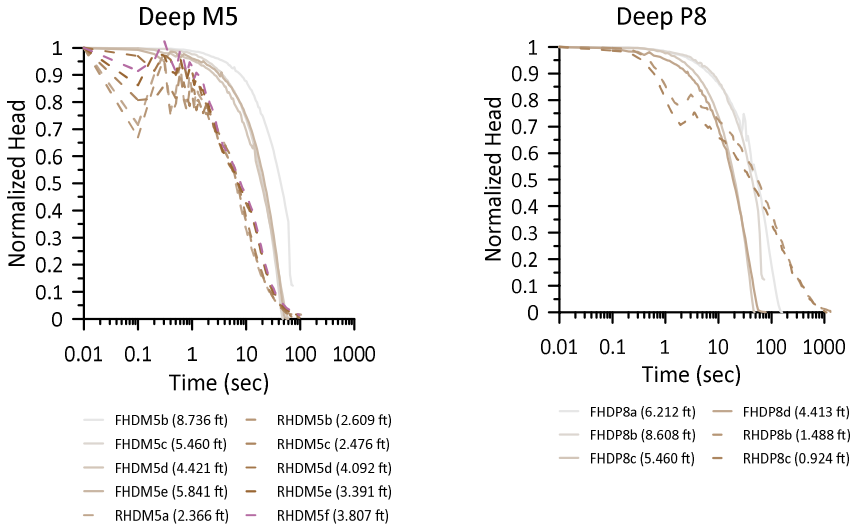
The shallow transect wells were completed by inflow methods with similar displacements for the multiple tests except for B1 and R7. The response curves for similar displacements generally coincide and confirms test method quality and reproducibility. The two intervals with differing displacements show temporal response differences. It is expected that if there are skin effects present, response with larger displacements will have longer recovery time in comparison to smaller displacements, demonstrating a degree of head dependency and skin effects. The skin effects may be potentially caused by local groundwater zone damage or the well design consisting of high-density polyethylene (HDPE) screen wrapped in 88 micron geotextile filer material. The response curves from shallow B1 and R7 correlate to this principle with a longer recovery time for the larger displacement (**Exhibit 1**).

**Exhibit 1**. Normalized response curves for shallow transect B1 and R7 that demonstrates head dependency from skin effects.




The deep transect wells were also mostly completed by inflow methods. Four well screens were additionally tested with pneumatic methods (M5, O6, R7, and P8). As with the shallow transect, the tests with similar displacements for the multiple FH tests have comparable responses. The well intervals with differing FH displacements both show generally consistent recovery time and differing recovery time. The consistent recovery time suggests the skin effects are likely not present. The wells screens M5 and P8 with temporal differences in recovery demonstrate head dependency. Pneumatic slug tests, RH, responses have observed early time test noise, differing recovery curve displacement relationship with time compared to the FH, and comparable response times with similar and differing displacements. The recovery curve differences with the two types of tests, FH and RH, may indicate that skin effects have a more pronounced effect with infiltration into the well screen, FH, in comparison to exfiltration with the RH that do not appear to have a clear head dependency. The response curves from deep M5 and P8 with FH and RH tests are shown below as **Exhibit 2**.

**Exhibit 2**. Normalized response curves for deep transect M5 and P8 that demonstrate head dependency from skin effects for FH tests and comparable responses for RH tests.



# Hydraulic Parameter Analysis

The response data for the VAP temporary screen intervals, vertical monitoring wells, and the horizontal well screen intervals were evaluated to estimate hydraulic parameters. The analysis solution reports are provided as **Attachment 2**. The results are also provided in summary tables **Table 1** through **3**, with testing details for the VAP, vertical monitoring wells, and horizontal wells, respectively.

The VAP temporary well screen testing was completed with pneumatic methods. The hydraulic conductivity estimates are consistent with a tight range from 1.0E-02 centimeters per second (cm/sec) to 4.8E-02 cm/sec. The hydraulic conductivity estimate generally correlates to the grain size descriptions. In addition, a weak correlation is present with increasing hydraulic conductivity with depth of the temporary screen.

The vertical monitoring well testing was completed by both solid and pneumatic methods. As with the VAP hydraulic testing results, the vertical monitoring well hydraulic conductivity estimates have a tight range from 1.9E-02 cm/sec to 5.2E-02 cm/sec and correlate to the grain size descriptions. The vertical monitoring wells also have a weak correlation with increasing hydraulic conductivity with depth.

The horizontal well testing was completed by inflow and pneumatic methods. Note that the horizontal well analysis involved applying physical dimensions for the horizontal well to best align with a traditional vertical well for applicability to the chosen solution analysis assumptions (**Table 3**). The results also have a tight range of hydraulic conductivity estimates from 1.0E-03 cm/sec to 6.0E-03 cm/sec and a similar weak correlation with increasing mean hydraulic conductivity with depth (1.9E-03 cm/sec with the shallow transect in comparison to 2.7E-03 with the deep transect). Importantly, the horizontal well test solution results are an order of magnitude less compared to the VAP and vertical wells and have implausibly low specific storage estimates. These responses are consistent with a skin effect response, which may be the result of the screen efficiency and geotextile fabric wrap used in the Vertebrae well construction. As such, the hydraulic conductivity values estimated from the horizontal wells are not considered reliable.

# Summary

The hydraulic testing implementation and analysis for the VAP, vertical monitoring wells, and horizontal well screens have provided increased insights with the Vertebrae™ design and the shallow groundwater zone hydraulic conductivity distribution. The evaluation of recovery responses, order of magnitude less hydraulic conductivity, and the implausibly low specific storage for the horizontal wells suggest likely skin effects are present.

To further compare hydraulic conductivity estimates for the shallow groundwater zone, the hydraulic conductivity results presented were combined with single well tracer test and grain size analysis from separate results. The combined results were charted by mid-screen or mid-interval collection depth in ft bgs versus hydraulic conductivity (cm/sec) on a log scale (**Exhibit 3**). The VAP temporary screen interval results are labeled as pore pressure dissipation tests with the HPT borings.

The significant lower hydraulic conductivity estimates for the horizontal wells are apparent and considered biased low and unreliable.  The grain size analysis results are consistently higher than all other estimates and likely indicate a high bias. The estimates from the other methods fall between the two end members with a few outliers present for the single well tracer test results. The results from the in-situ methods suggest a possible slight

correlation with increasing hydraulic conductivity with depth; however, a depth correlation for the grain size analysis results is not apparent.

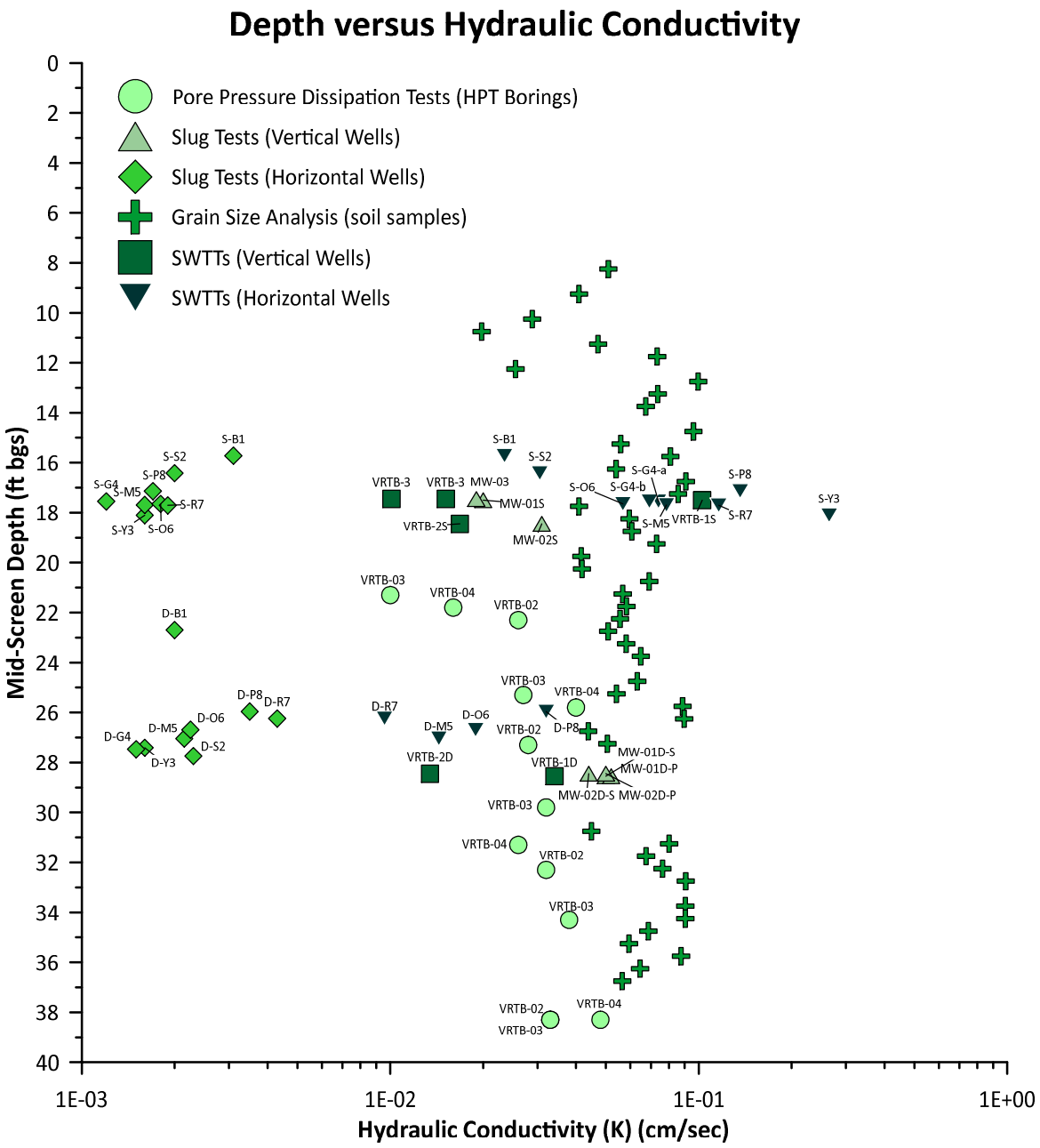



**Exhibit 3**. Semi-log chart of hydraulic conductivity estimates with depth from multiple analysis results.

# References

Butler Jr, J.J., 2019. *The design, performance, and analysis of slug tests*. Crc Press.

Duffield, G.M., 2007. AQTESOLV for Windows User's Guide. Version 4.5, HydroSOLVE. *Inc., Reston*.

**Tables**

Table 1 VAP Slug Testing Results
Table 2 Monitoring Well Slug Testing Results
Table 3 Vertebrae™ Well Slug Testing Results

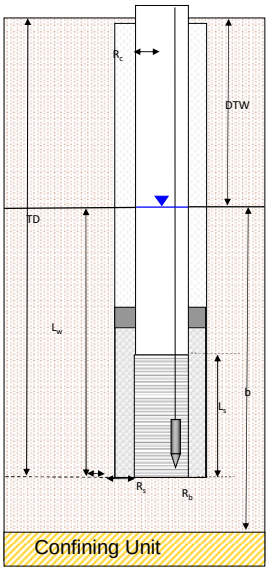
**Attachments**

Attachment 1 Response Curve Evaluation
Attachment 2 Analysis Solution Reports

# Tables

# Table 1
# VAP Slug Testing Results
# Grayling Airfield, Michigan

| Boring ID | Constructed Screen Interval (ft bgs) | | Saturated Thickness[1] (ft) | General Screened Interval Description | Slug Test Type[2] | Hydraulic Conductivity (cm/sec) | Analysis Method |
|---|---|---|---|---|---|---|---|
| VAP-VRTB-02 | 20.6 - 24 | 22.3 | 8.7 | sand, medium to very coarse, some small to large pebbles, little granules, poorley sorted, wet, brown | pneumatic (30" WC) | 2.6E-02 | Butler-Zhan |
| | | 22.3 | | | pneumatic (50" WC) | 2.0E-02 | Butler-Zhan |
| | 25.6 - 29 | 27.3 | 13.7 | fine to coarse sand, little very coarse sand and granules, trace small pebbles, poorly sorted, wet, brown | pneumatic (30" WC) | 2.8E-02 | Butler-Zhan |
| | | 27.3 | | | pneumatic (50" WC) | 2.3E-02 | Butler-Zhan |
| | 30.6 - 34 | 32.3 | 18.7 | fine to coarse sand, little very coarse sand and granules, trace small pebbles, poorly sorted, wet, brown | pneumatic (30" WC) | 3.2E-02 | Butler-Zhan |
| | | 32.3 | | | pneumatic (50" WC) | 2.5E-02 | Butler-Zhan |
| | 36.6 - 40 | 38.3 | 24.7 | fine to coarse sand, some very coarse sand and granules, little small to medium pebbles, poorly sorted, wet, brown | pneumatic (30" WC) | 3.3E-02 | Butler-Zhan |
| | | 38.3 | | | pneumatic (50" WC) | 2.7E-02 | Butler-Zhan |
| VAP-VRTB-03 | 19.6 - 23 | 21.3 | 7.5 | very fine to coarse sand, some very coarse sand to small bellbes, little medium to large pebbles, trace silt, poorly sorted, wet, brown | pneumatic (30" WC) | 1.0E-02 | Bouwer and Rice |
| | | | | | pneumatic (50" WC) | | -- |
| | 23.6 - 27 | 25.3 | 11.5 | very fine to coase sand, some very coarse sand to small pebbles, trace silt, poorly sorted, wet | pneumatic (30" WC) | 2.7E-02 | Butler-Zhan |
| | | 25.3 | | | pneumatic (50" WC) | 2.2E-02 | Butler-Zhan |
| | 28.1 - 31.5 | 29.8 | 16.0 | fine to very coase sand and granules to small pebbles, trace medium to very large pebbles, trace silt, poorly sorted, wet | pneumatic (30" WC) | 3.2E-02 | Butler-Zhan |
| | | 29.8 | | | pneumatic (50" WC) | 2.8E-02 | Butler-Zhan |
| | 32.6 - 36 | 34.3 | 20.5 | fine to very coarse sand and granules to small pebbles, little medium pebbles, trace silt, poorly sorted, wet, brown | pneumatic (30" WC) | 3.8E-02 | Butler-Zhan |
| | | 34.3 | | | pneumatic (50" WC) | 2.5E-02 | Butler-Zhan |
| | 36.6 - 40 | 38.3 | 24.5 | fine to coarse sand, little very coarse sand to granules, trace small pebbles, trace silt, poorly sorted, wet, brown | pneumatic (30" WC) | 3.3E-02 | Butler-Zhan |
| | | 38.3 | | | pneumatic (50" WC) | 2.4E-02 | Butler-Zhan |
| VAP-VRTB-04 | 20.1 - 23.5 | 21.8 | 8.3 | medium sand, little to some fine sand, trace very fine sand, little granules to small pebbles, trace medium to large pebbles, trace silt, poorly sorted, wet, pale brown | pneumatic (30" WC) | 1.6E-02 | Butler-Zhan |
| | | | | | pneumatic (50" WC) | | -- |
| | 24.1 - 27.5 | 25.8 | 12.3 | medium sand, little to some fine sand, trace coarse sand, trace granules, trace silt, well sorted, wet, pale brown | pneumatic (30" WC) | 4.0E-02 | Butler-Zhan |
| | | | | | pneumatic (50" WC) | | -- |
| | 29.6 - 33 | 31.3 | 17.8 | very fine to fine sand, little medium sand, trace granules, trace silt, well sorted, wet, pale brown | pneumatic (30" WC) | 2.6E-02 | Butler-Zhan |
| | | 31.3 | | | pneumatic (50" WC) | 2.3E-02 | Butler-Zhan |
| | 36.6 - 40 | 38.3 | 24.8 | fine sand, little to some very fine sand, trace to little silt, well sorted, wet, pale brown | pneumatic (30" WC) | 4.8E-02 | Butler-Zhan |
| | | 38.3 | | | pneumatic (50" WC) | 4.8E-02 | Butler-Zhan |




| Well | Ls | Lw[3] | Rs | Rb | Rc | DTW | TD[4] |
|---|---|---|---|---|---|---|---|
| VAP-VRTB-02 | 3.42 | 8.7 | 0.0260 | 0.3125 | 0.0260 | 15.3 | 24.0 |
| VAP-VRTB-02 | 3.42 | 13.7 | 0.0260 | 0.3125 | 0.0260 | 15.3 | 29.0 |
| VAP-VRTB-02 | 3.42 | 18.7 | 0.0260 | 0.3125 | 0.0260 | 15.3 | 34.0 |
| VAP-VRTB-02 | 3.42 | 24.7 | 0.0260 | 0.3125 | 0.0260 | 15.3 | 40.0 |
| VAP-VRTB-03 | 3.42 | 7.5 | 0.0260 | 0.3125 | 0.0260 | 15.5 | 23.0 |
| VAP-VRTB-03 | 3.42 | 11.5 | 0.0260 | 0.3125 | 0.0260 | 15.5 | 27.0 |
| VAP-VRTB-03 | 3.42 | 16.0 | 0.0260 | 0.3125 | 0.0260 | 15.5 | 31.5 |
| VAP-VRTB-03 | 3.42 | 20.5 | 0.0260 | 0.3125 | 0.0260 | 15.5 | 36.0 |
| VAP-VRTB-03 | 3.42 | 24.5 | 0.0260 | 0.3125 | 0.0260 | 15.5 | 40.0 |
| VAP-VRTB-04 | 3.42 | 8.3 | 0.0260 | 0.3125 | 0.0260 | 15.2 | 23.5 |
| VAP-VRTB-04 | 3.42 | 12.3 | 0.0260 | 0.3125 | 0.0260 | 15.2 | 27.5 |
| VAP-VRTB-04 | 3.42 | 17.8 | 0.0260 | 0.3125 | 0.0260 | 15.2 | 33.0 |
| VAP-VRTB-04 | 3.42 | 24.8 | 0.0260 | 0.3125 | 0.0260 | 15.2 | 40.0 |

All units in feet

2.8E-02
0.00900417
32%

$L_s$ True screen length
$L_w$ Length of water column in Well (TD-DTW)
$R_s$ Screen radius
$R_b$ Radius of filter pack or borehole
$R_c$ Casing radius
DTW Static depth to water below top of casing
TD Total depth of well/screen below top of casing

**Notes**

ft bgs = feet below ground surface
cm/sec = centimeters per second
WC = water column equivelant pressure in inches of water
-- = test results inconclusive due to limited recorded or anomalous recovery
[1] Saturated thickness based on water column with dominant radial flow
[2] Pneumatic slug tests (rising head) with pressure of 30-inches and 50 inches; actual test response less than pressure head likely due to pressure gauge inaccuracy
[3] Water column equivalent to measured total depth of well and depth to water
[4] Total depth of well from measured value

**References**


Bouwer, H. and R.C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resources Research, vol. 12, no. 3, pp. 423-428.

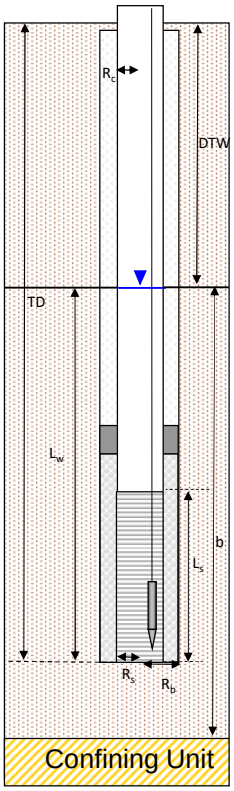
Bouwer, H., 1989. The Bouwer and Rice slug test--an update, Ground Water, vol. 27, no. 3, pp. 304-309.

Butler, J.J., Jr. and X. Zhan, 2004. Hydraulic tests in highly permeable aquifers, Water Resources Research, vol. 40, W12402, doi:10.1029/2003WR002998.

Butler Jr, J.J., 2019. The design, performance, and analysis of slug tests. Crc Press.

# Table 2
# Monitoring Well Slug Testing Results
# Grayling Airfield, Michigan

| Boring ID | Constructed Screen Interval (ft bgs) | Saturated Thickness[1] (ft) | General Screened Interval Description | Slug Test Type[2] | Test Number[3] | Hydraulic Conductivity (cm/sec) | Analysis Method |
|---|---|---|---|---|---|---|---|
| MW-01S | 15.0 to 20.0 | 4.9 | Not available | Solid - Rising Head | 2 | 2.0E-02 | Springer-Gelhar |
| MW-01D | 26.5 to 30.6 | 15.4 | Not available | Solid - Rising Head | 1 | 5.0E-02 | Springer-Gelhar |
| MW-01D | 26.5 to 30.6 | 17.3 | Not available | Pneumatic - Rising Head | 2 | 5.2E-02 | Springer-Gelhar |
| MW-02S | 16.0 to 20.9 | 5.6 | mediume to coarse sand, some very coarse sand granules, little smalle pebbles, poortly sorted, wet, pale brown | Solid - Rising Head | 1 | 3.1E-02 | Springer-Gelhar |
| MW-02D | 26.0 to 30.9 | 15.4 | fine to coarse sand, little very coarse sand and granules, trace small pebbles, poorly sorted, wet, brown | Solid - Rising Head | 1 | 4.4E-02 | Springer-Gelhar |
| MW-02D | 26.0 to 30.9 | 17.4 | fine to coarse sand, little very coarse sand and granules, trace small pebbles, poorly sorted, wet, brown | Pneumatic - Rising Head | 3 | 5.0E-02 | Springer-Gelhar |
| MW-03 | 15.0 to 19.9 | 4.9 | fined to coarse sand, some very coarse sand and granules, little smale to large pebbles, trace silt, poorly sorted, wet , yellowish brown | Solid - Rising Head | 2 | 1.9E-02 | Springer-Gelhar |




| Well | Ls | Lw[1] | Le[4] | Rs | Rb | Rc | DTW | TD[5] |
|---|---|---|---|---|---|---|---|---|
| MW-01S | 5.0 | 4.89 | 4.89 | 0.08 | 0.33 | 0.08 | 15.12 | 20.0 |
| MW-01D - Solid | 4.1 | 15.36 | -- | 0.08 | 0.33 | 0.08 | 15.20 | 30.6 |
| MW-01D - Pneumatic | 4.1 | 17.28 | -- | 0.08 | 0.33 | 0.08 | 13.28 | 30.6 |
| MW-02S | 4.9 | 5.56 | -- | 0.08 | 0.33 | 0.08 | 15.37 | 20.9 |
| MW-02D - Solid | 4.9 | 15.52 | -- | 0.08 | 0.33 | 0.08 | 15.35 | 30.9 |
| MW-02D - Pneumatic | 4.9 | 17.43 | -- | 0.08 | 0.33 | 0.08 | 13.44 | 30.9 |
| MW-03 | 4.9 | 4.90 | -- | 0.08 | 0.33 | 0.08 | 14.96 | 19.9 |

All units in feet

$L_s$ True screen length
$L_w$ Length of water column in well
$L_e$[4] Effective screen length
$R_s$ Screen radius
$R_b$ Radius of filter pack
$R_c$ Casing radius
DTW Static depth to water bgs
TD Total depth of well
b Saturated thickness

**Notes**

ft bgs = feet below ground surface
cm/sec = centimeters per second
-- not applicable
[1] Saturated thickness based on water column with dominated radial flow
[2] Solid slug size 1-inch diameter and 2.9 feet in length. Pneumatic slug tests at actual recorded displacement pressure due to pressure gauge inaccuracy
[3] Three tests completed with solid slug at each well; three tests completed with pneumatic methods at two differing displacements totaling six tests per well; test with least amount of noise used for hydraulic conductivity estimate
[4] Effective screen lenght used due to partially submerged screen
[5] Total depth of well from measured value

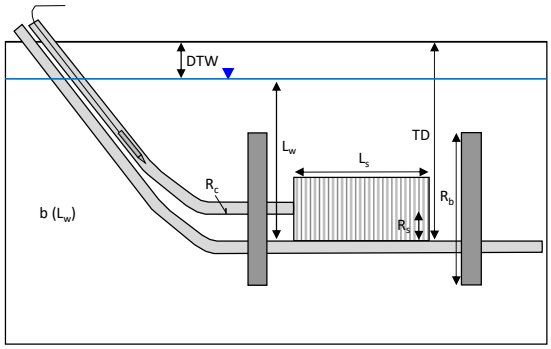
**References**


Butler Jr, J.J., 2019. The design, performance, and analysis of slug tests. Crc Press.

Springer, R.K. and L.W. Gelhar, 1991. Characterization of large-scale aquifer heterogeneity in glacial outwash by analysis of slug tests with oscillatory response, Cape Cod, Massachusetts, U.S. Geol. Surv. Water Res. Invest. Rep. 91-4034, pp. 36-40.

# Table 3
# Vertebrae™ Well Slug Testing Results
# Grayling Airfield, Michigan

| Transect and Screen ID | Constructed Screen Invert Depth (ft bgs) | Saturated Thickness[1] (ft) | Slug Test Type[3] | Test Number[3] | Hydraulic Conductivity (cm/sec) | Analysis Method |
|---|---|---|---|---|---|---|
| Shallow B1 | 15.76 | 10.00 | Inflow (falling head)[2] | 1 | 3.1E-03 | KGS |
| Shallow S2 | 16.46 | 10.00 | Inflow (falling head) | 1 | 2.0E-03 | KGS |
| Shallow Y3 | 18.14 | 10.00 | Inflow (falling head) | 2 | 1.6E-03 | KGS |
| Shallow G4 | 17.59 | 10.00 | Inflow (falling head) | 3 | 1.2E-03 | KGS |
| Shallow M5 | 17.73 | 10.00 | Inflow (falling head) | 3 | 1.6E-03 | KGS |
| Shallow O6 | 17.69 | 10.00 | Inflow (falling head) | 3 | 1.8E-03 | KGS |
| Shallow R7 | 17.75 | 10.00 | Inflow (falling head) | 3 | 1.9E-03 | KGS |
| Shallow P8 | 17.18 | 10.00 | Inflow (falling head) | 3 | 1.7E-03 | KGS |
| Deep B1 | 22.74 | 10.00 | Inflow (falling head) | 2 | 2.0E-03 | KGS |
| Deep S2 | 27.78 | 10.00 | Inflow (falling head) | 3 | 2.3E-03 | KGS |
| Deep Y3 | 27.45 | 10.00 | Inflow (falling head) | 3 | 1.6E-03 | KGS |
| Deep G4 | 27.51 | 10.00 | Inflow (falling head) | 3 | 1.5E-03 | KGS |
| Deep M5 | 27.00 | 10.00 | Inflow (falling head) | 3 | 1.0E-03 | KGS |
| | | | Pneumatic (rising head | 3 | 3.3E-03 | KGS |
| Deep O6 | 26.73 | 10.00 | Inflow (falling head) | 3 | 1.1E-03 | KGS |
| | | | Pneumatic (rising head | 3 | 3.4E-03 | KGS |
| Deep R7 | 26.28 | 10.00 | Inflow (falling head) | 3 | 1.6E-03 | KGS |
| | | | Pneumatic (rising head | 2 | 7.0E-03 | KGS |
| Deep P8 | 26.73 | 10.00 | Inflow (falling head) | 3 | 1.0E-03 | KGS |
| | | | Pneumatic (rising head | 3 | 6.0E-03 | KGS |




| Well | Ls | Lw | Rs | Rb | Rc | DTW | TD |
|---|---|---|---|---|---|---|---|
| Shallow B1 | 10.0 | 0.76 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 15.76 |
| Shallow S2 | 10.0 | 1.46 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 16.46 |
| Shallow Y3 | 10.0 | 3.14 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 18.14 |
| Shallow G4 | 10.0 | 2.59 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 17.59 |
| Shallow M5 | 10.0 | 2.73 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 17.73 |
| Shallow O6 | 10.0 | 2.69 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 17.69 |
| Shallow R7 | 10.0 | 2.75 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 17.75 |
| Shallow P8 | 10.0 | 2.18 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 17.18 |
| Deep B1 | 10.0 | 7.74 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 22.74 |
| Deep S2 | 10.0 | 12.78 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 27.78 |
| Deep Y3 | 10.0 | 12.45 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 27.45 |
| Deep G4 | 10.0 | 12.51 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 27.51 |
| Deep M5 | 10.0 | 12.08 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 27.00 |
| Deep O6 | 10.0 | 11.73 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 26.73 |
| Deep R7 | 10.0 | 11.28 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 26.28 |
| Deep P8 | 10.0 | 11.00 | 0.0417 | 0.1667 | 0.0313 | 15.00 | 26.73 |

**Notes**

ft bgs = feet below ground surface
cm/sec = centimeters per second
-- not applicable

[1] Saturated thickness and water column assumed to be at least 10 feet (equal to horizontal screen length and localized influence near well).

[2] Inflow (falling head) slug test completed by inducing water. Resulting recovery was not instantaneous and demonstration compared to rising head tests (pneumatic) performed in some of the deep well screens suggest an effect of well skin reducing the hdyraulic connectivity with the formation. The curve match with implausibly low Ss (well skin) was best estimated by matching with curve crossing 0.7 normalized head displacement.

[3] Three to five inflow tests were completed with introducing water to the well. Six pneumatic tests were completed at DM5, DO6, DR7, and DP8 at two differing pressures (approximately 30 and 50 inches of water pressure); actual test response pressure head differs and likely due to pressure gauge inaccuracy. Test responses were reviewed and test with least amount of noise was chosen for curve matching. Test responses were also evaluated for head dependency; three tests completed with pneumatic methods at two differing displacements totaling six tests per well; test with least amount of noise used for hydraulic conductivity estimate.

**References**

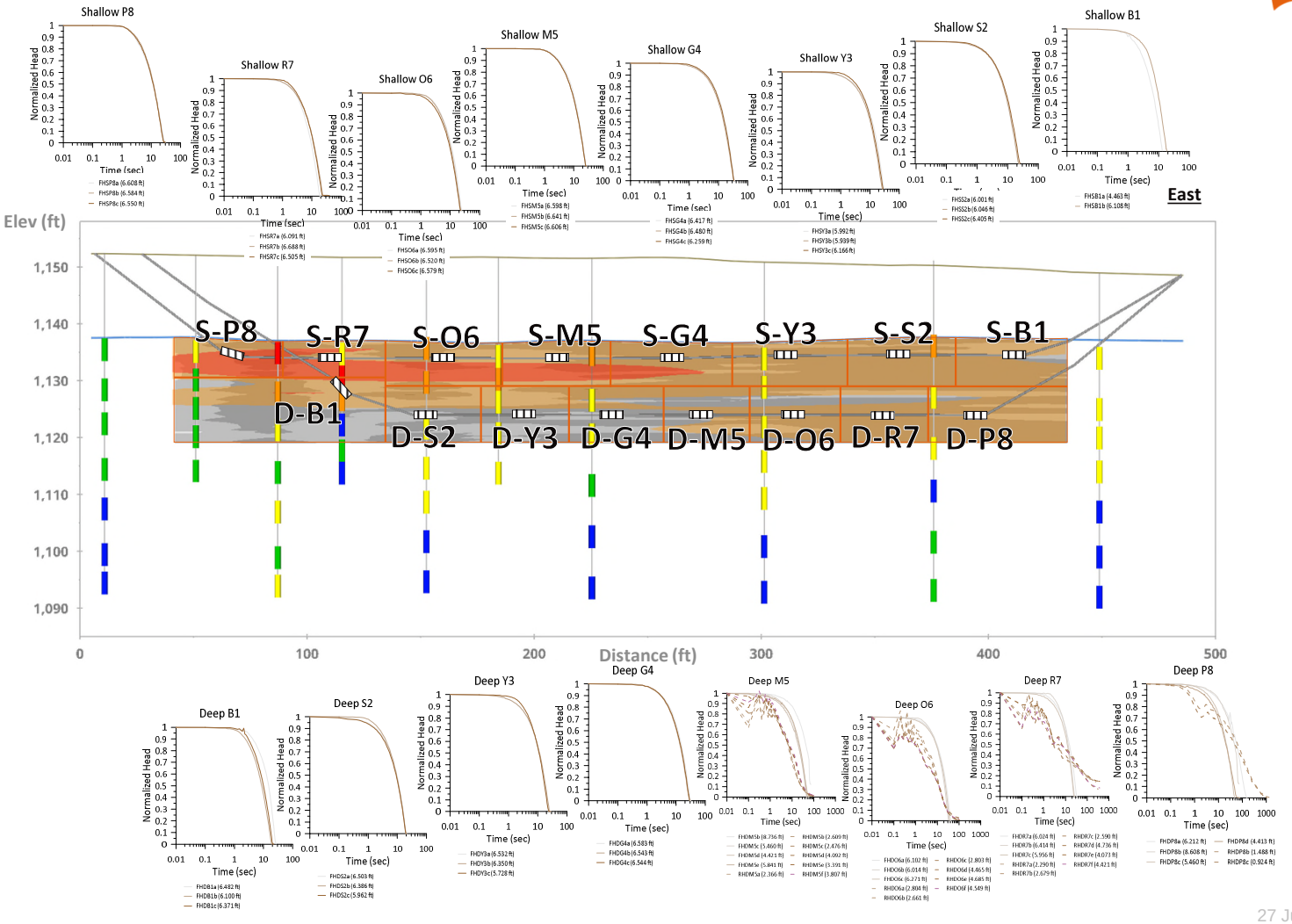
Butler Jr, J.J., 2019. The design, performance, and analysis of slug tests. Crc Press.

Hyder, Z, J.J. Butler, Jr., C.D. McElwee and W. Liu, 1994. Slug tests in partially penetrating wells, Water Resources Research, vol. 30, no. 11, pp. 2945-2957.

# Attachment 1

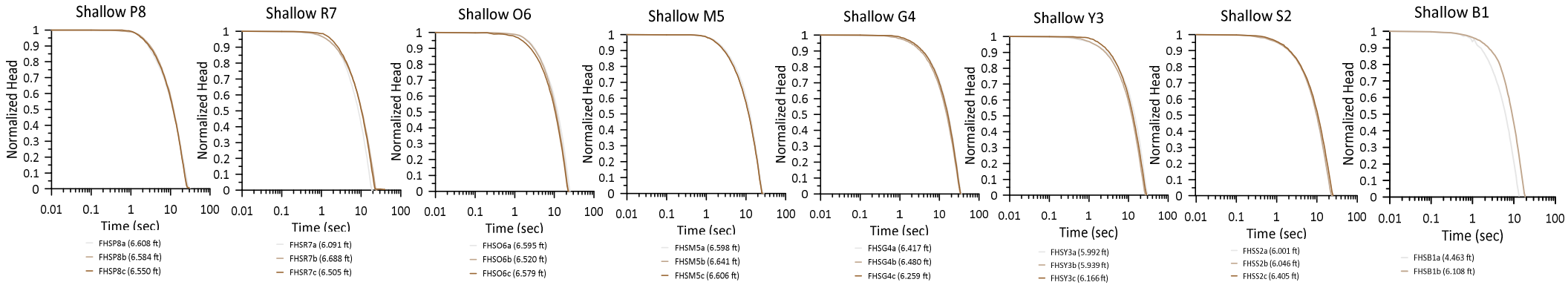
## Response Curve Evaluation

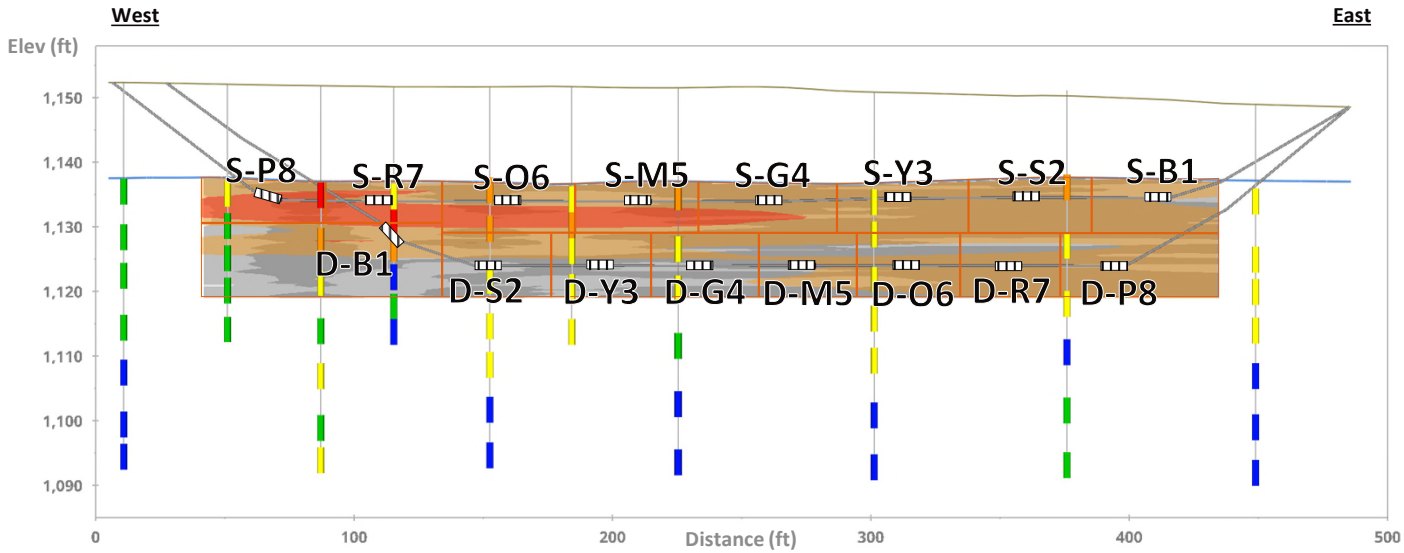
# Response Curve Evaluation




© Arcadis 2022

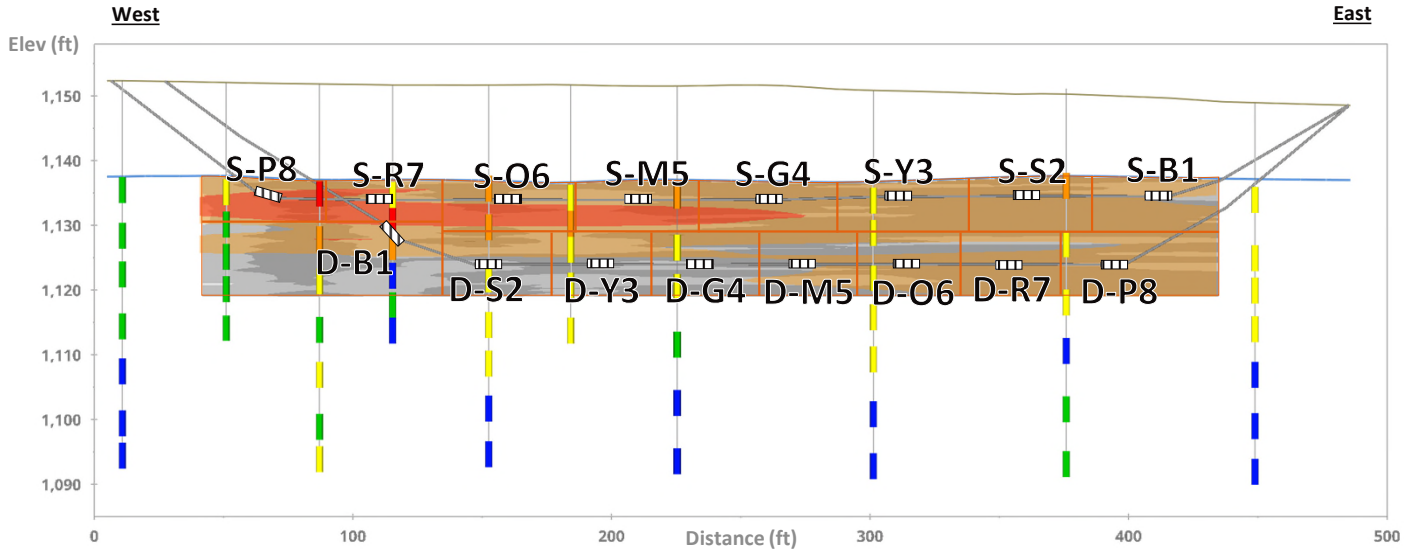
# Response Curve Evaluation - Shallow

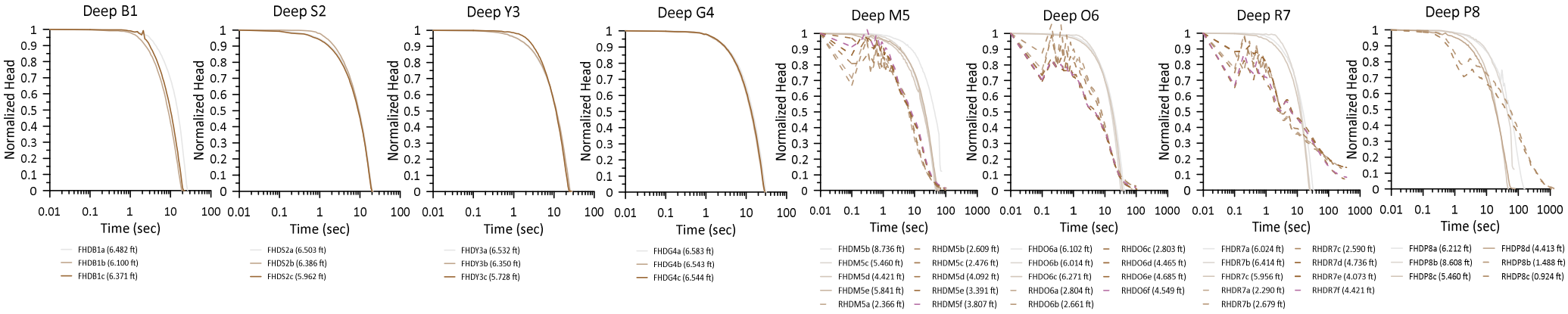



© Arcadis 2022

# Response Curve Evaluation – Deep



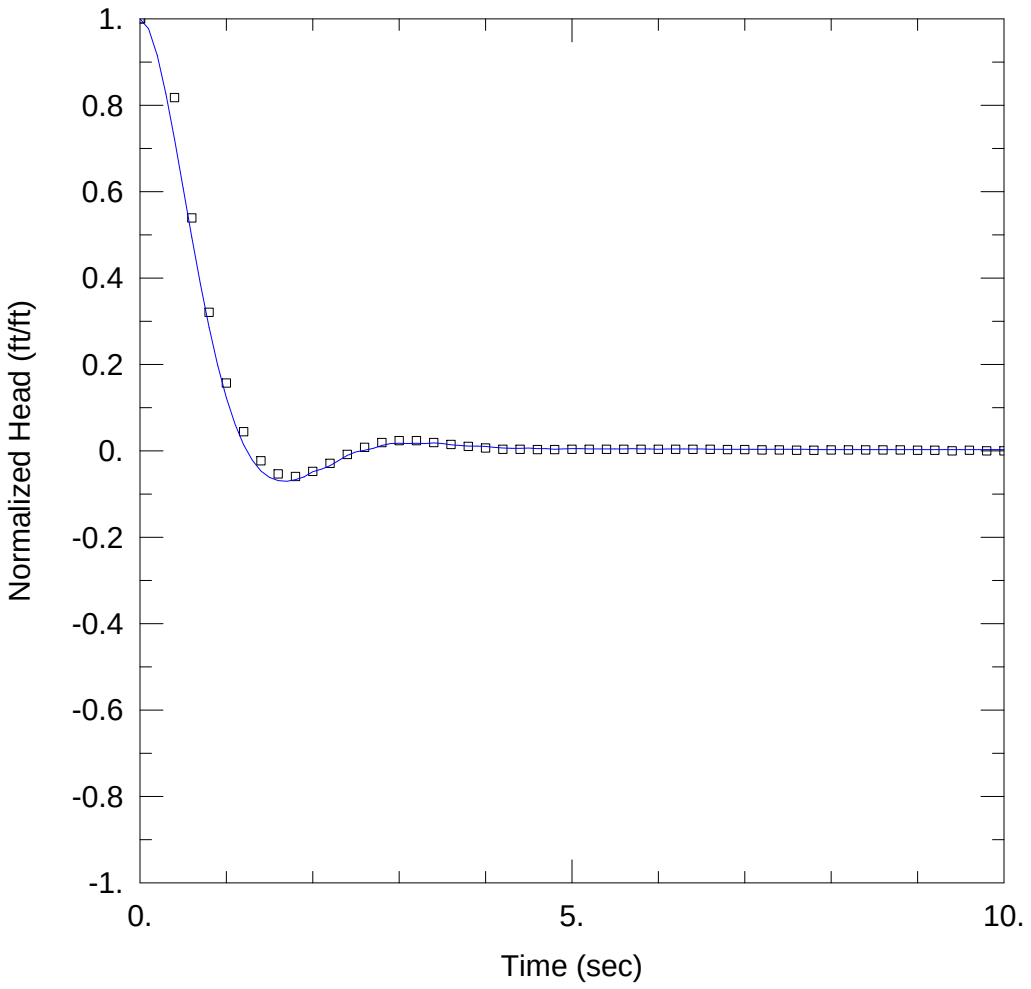

© Arcadis 2022

# Attachment 2

## Analysis Solution Reports

# VAP-VRTB-02 20.6-24

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.026 cm/sec  Ss = 2.4E-5 $ft^{-1}$
Kz/Kr = 0.7  Le = 6.5 ft

## AQUIFER DATA

Saturated Thickness: 8.7 ft (Kz/Kr): 0.7

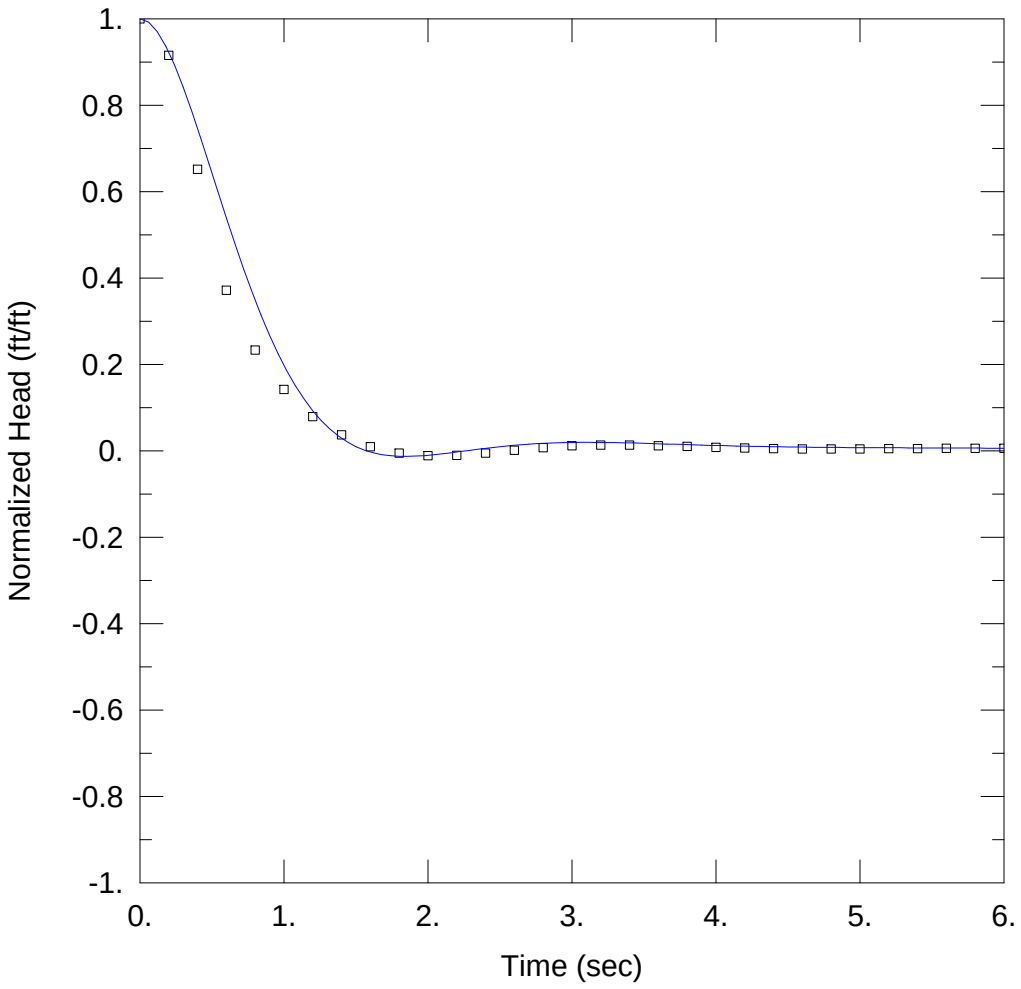
### WELL DATA (VAP-VRTB-02_20.6-24_30")

Initial Displacement: 1.129 ft
Static Water Column Height: 8.7 ft
Total Well Penetration Depth: 8.7 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-02 20.6-24

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.02 cm/sec  Ss = 7.5E-5 $ft^{-1}$
Kz/Kr = 0.7  Le = 7.13 ft

## AQUIFER DATA

Saturated Thickness: 8.7 ft (Kz/Kr): 0.7

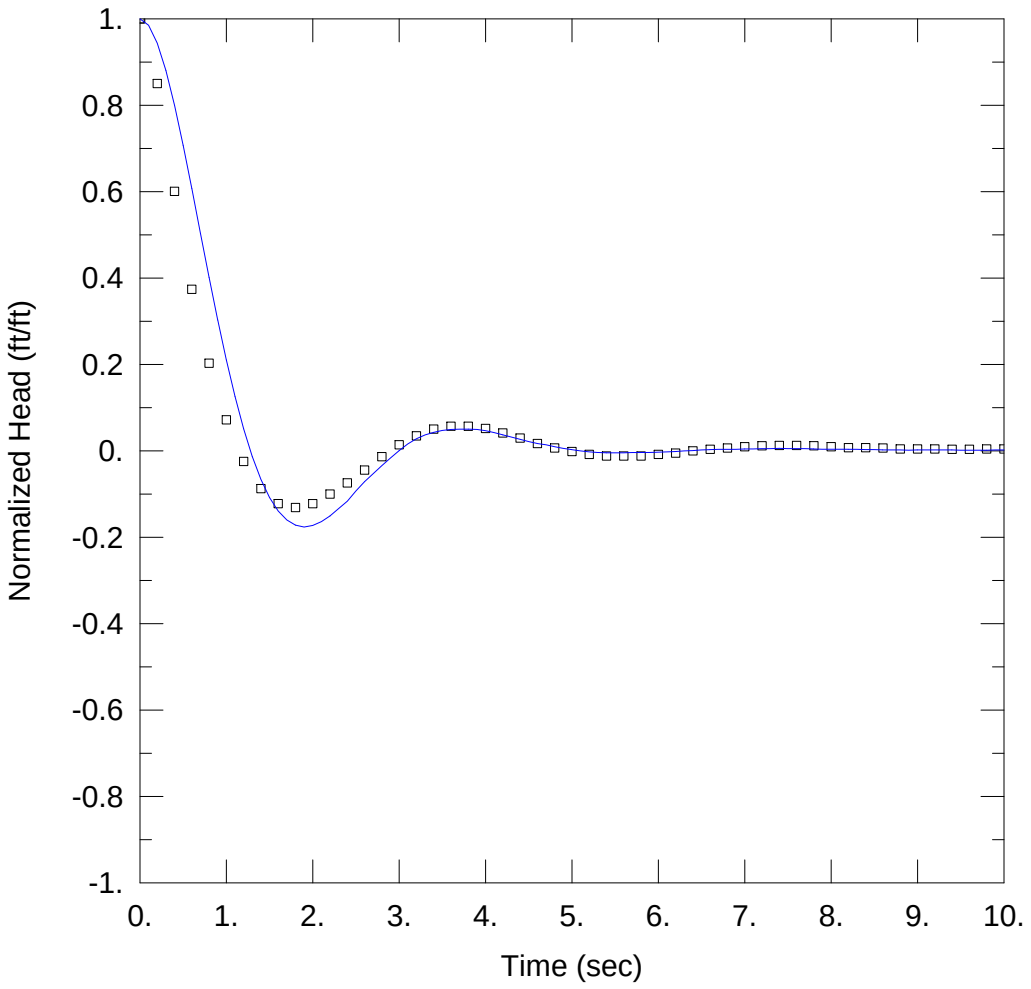
### WELL DATA (VAP-VRTB-02_20.6-24_50")

Initial Displacement: 3.83 ft
Static Water Column Height: 8.7 ft
Total Well Penetration Depth: 8.7 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-02 25.6-29

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.028 cm/sec  Ss = 7.6E-5 $ft^{-1}$
Kz/Kr = 0.3  Le = 10.42 ft

## AQUIFER DATA

Saturated Thickness: 13.7ft (Kz/Kr): 0.3

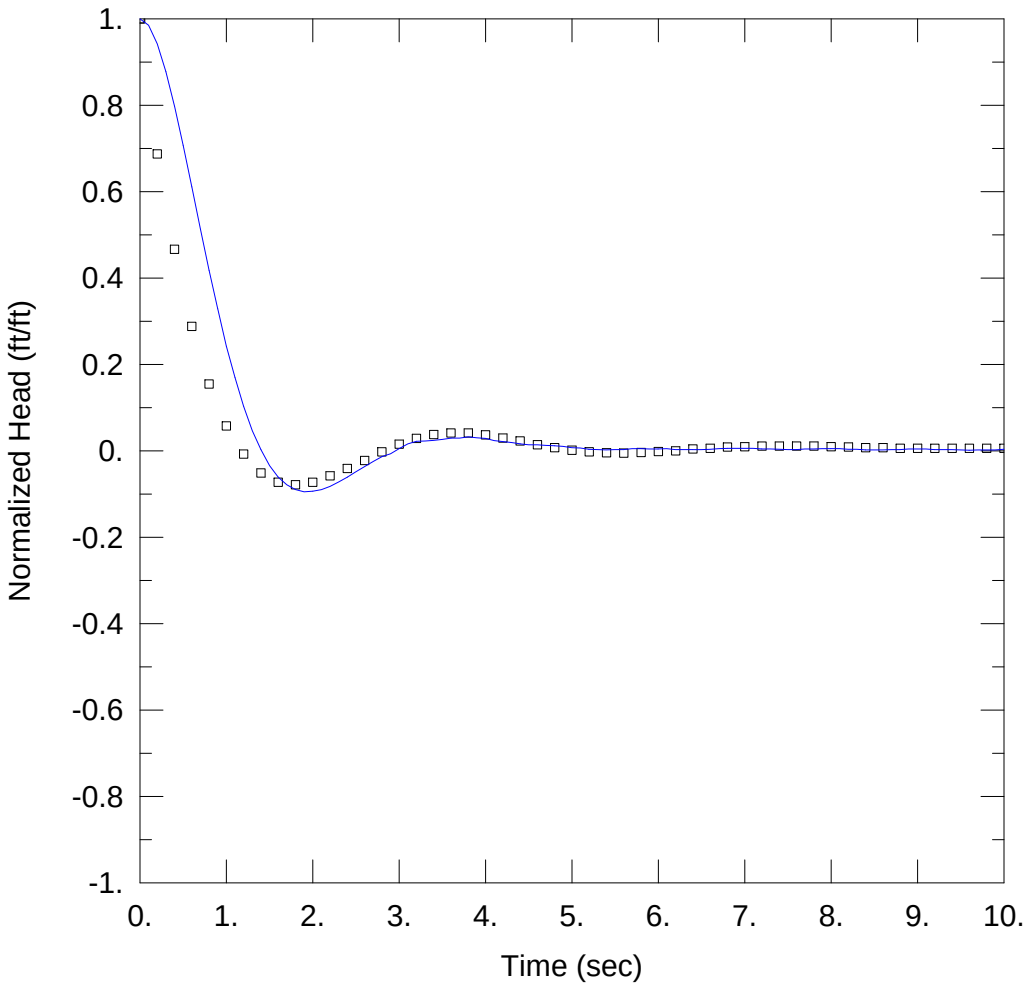
### WELL DATA (VAP-VRTB-02_25.6-29_30")

Initial Displacement: 0.953 ft
Static Water Column Height: 13.7 ft
Total Well Penetration Depth: 13.7 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-02 25.6-29

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.023 cm/sec  Ss = 7.6E-5 $ft^{-1}$
Kz/Kr = 0.3  Le = 9.95 ft

## AQUIFER DATA

Saturated Thickness: 13.7ft (Kz/Kr): 0.3

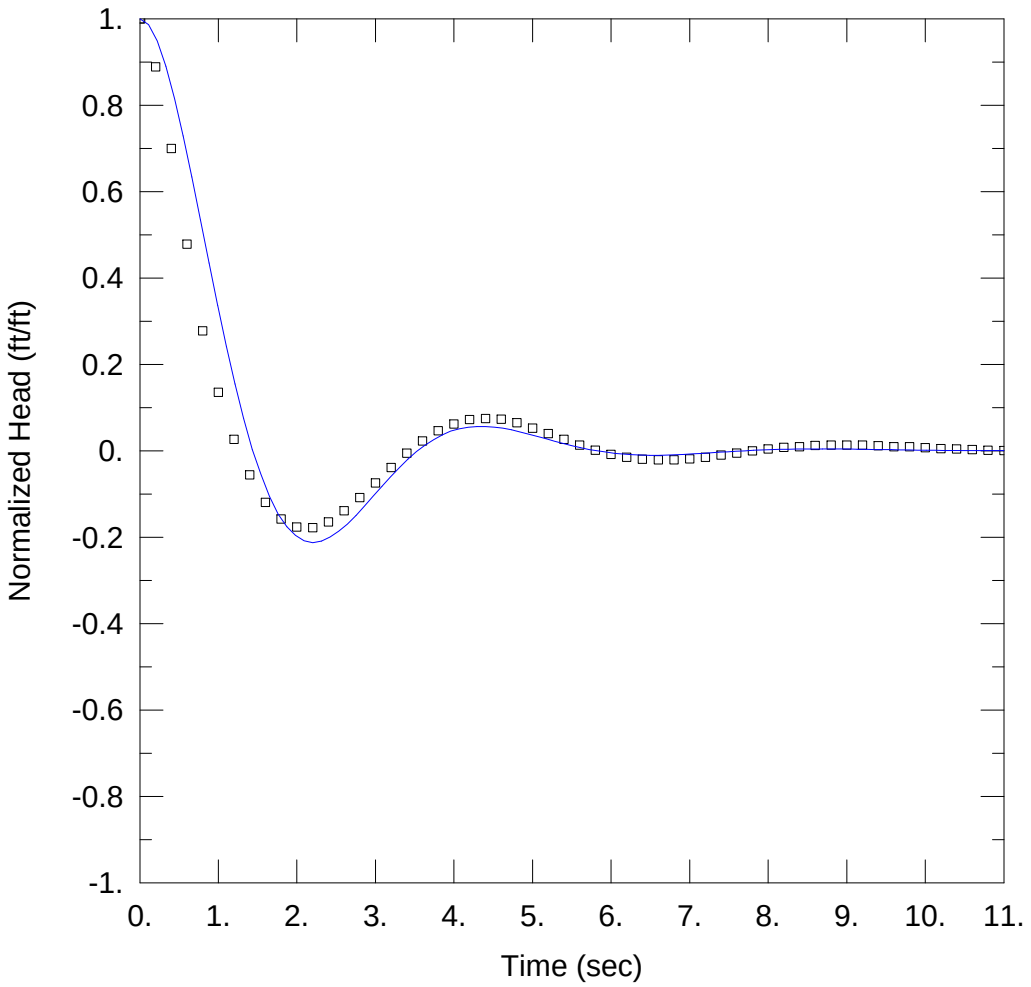
### WELL DATA (VAP-VRTB-02_25.6-29_50")

Initial Displacement: 1.529 ft
Static Water Column Height: 13.7 ft
Total Well Penetration Depth: 13.7 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-02 30.6-34

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.032 cm/sec  Ss = 1.3E-5 $ft^{-1}$
Kz/Kr = 0.1  Le = 13.87 ft

## AQUIFER DATA

Saturated Thickness: 18.7ft (Kz/Kr): 0.1

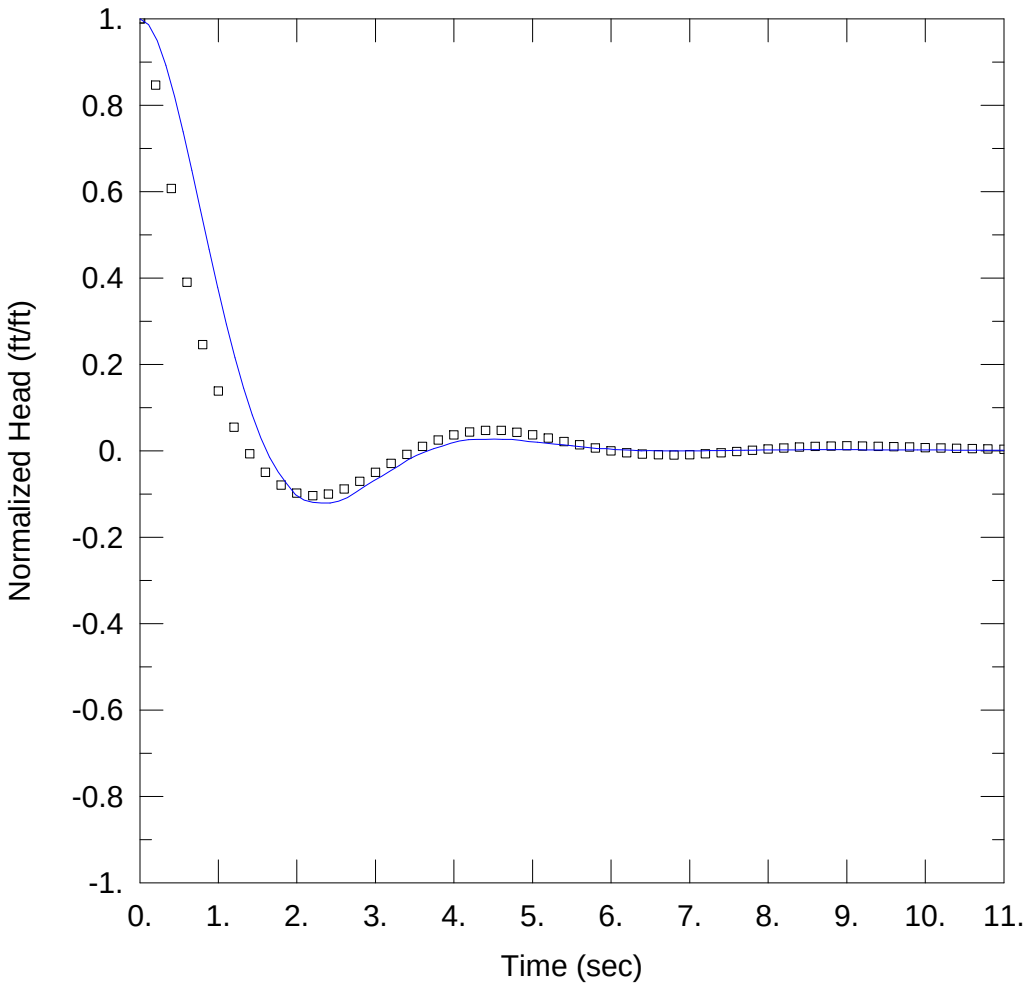
### WELL DATA (VAP-VRTB-02_30.6-34_30")

Initial Displacement: 1.458 ft
Static Water Column Height: 18.7 ft
Total Well Penetration Depth: 18.7 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-02 30.6-34

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.025 cm/sec  Ss = 1.2E-5 $ft^{-1}$
Kz/Kr = 0.1  Le = 13.8 ft

## AQUIFER DATA

Saturated Thickness: 18.7ft (Kz/Kr): 0.1

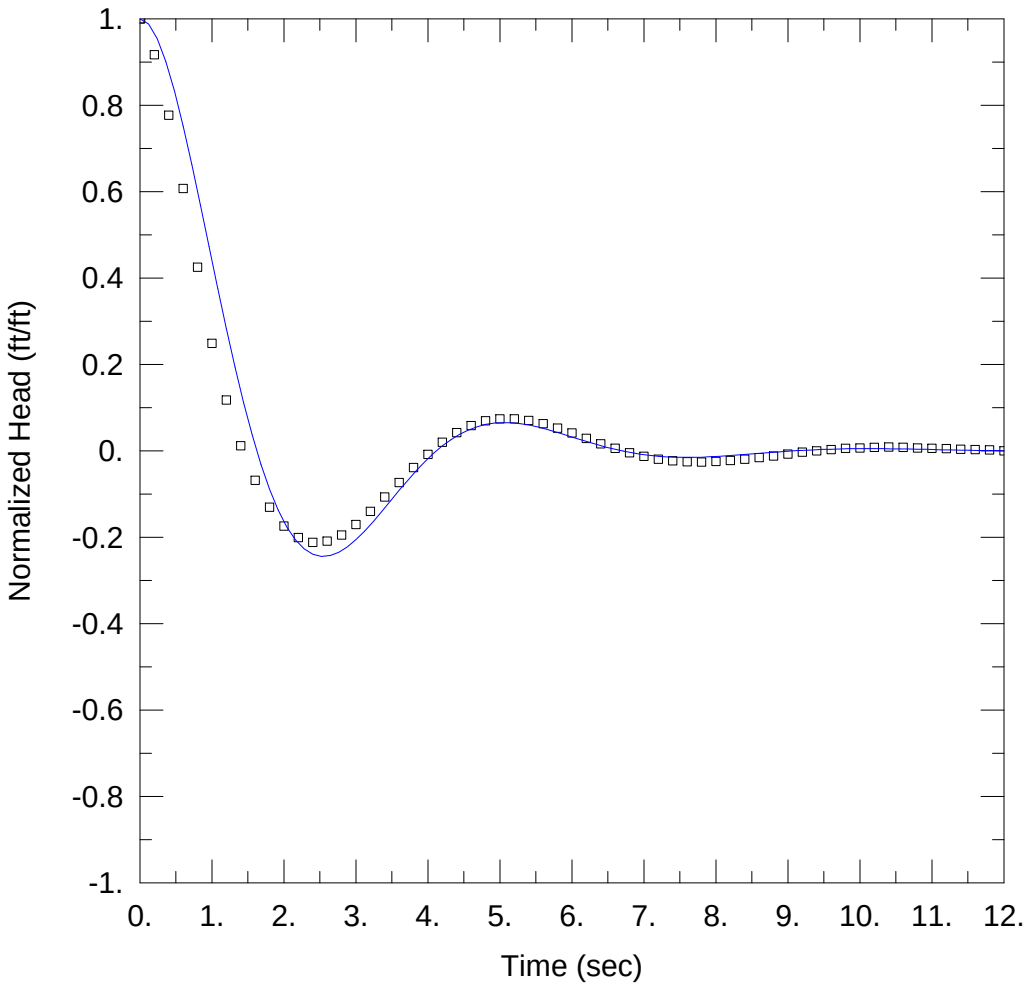
### WELL DATA (VAP-VRTB-02_30.6-34_50")

Initial Displacement: 2.682 ft
Static Water Column Height: 18.7 ft
Total Well Penetration Depth: 18.7 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-02 36.6-40

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.033 cm/sec  Ss = 3.5E-6 $ft^{-1}$
Kz/Kr = 0.1  Le = 18.4 ft

## AQUIFER DATA

Saturated Thickness: 24.7ft (Kz/Kr): 0.1

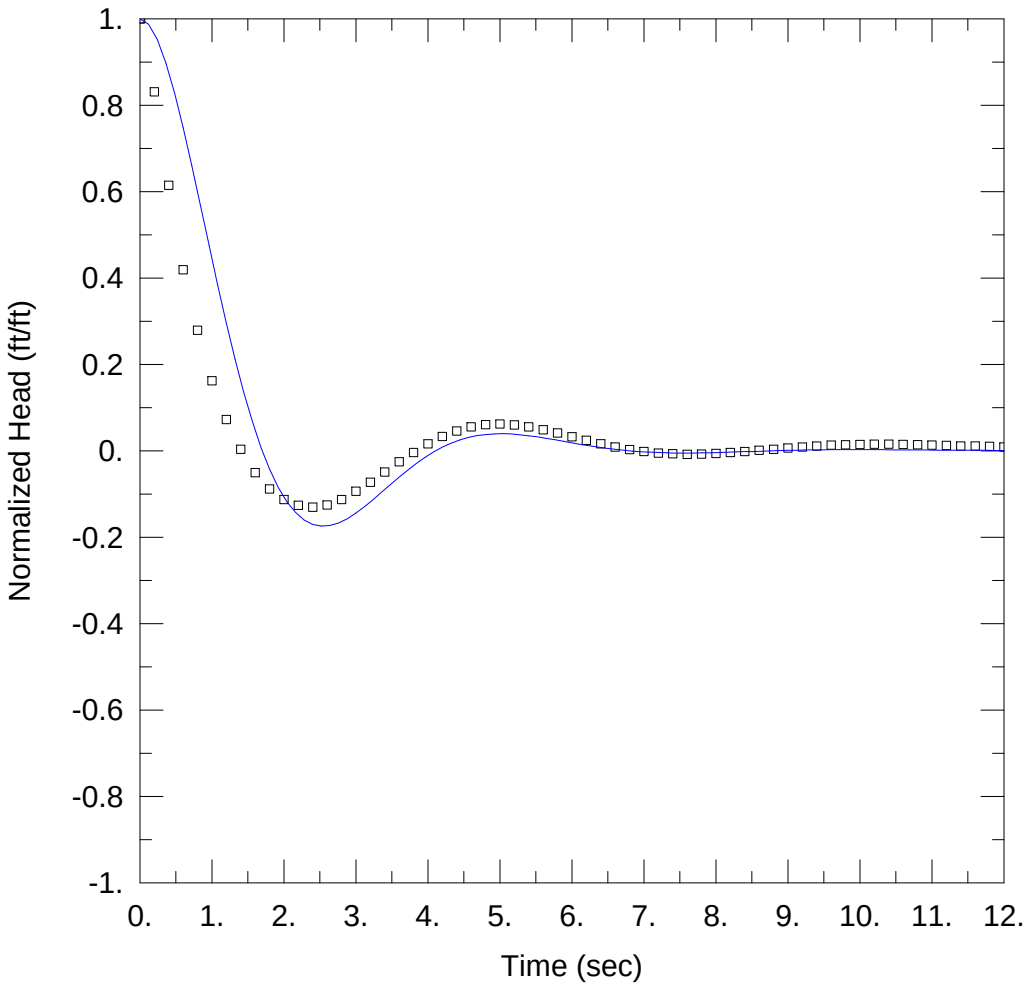
### WELL DATA (VAP-VRTB-02_36.6-40_30")

Initial Displacement: 1.734 ft
Static Water Column Height: 24.7 ft
Total Well Penetration Depth: 24.7 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-02 36.6-40

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.027 cm/sec  Ss = 8.0E-6 $ft^{-1}$
Kz/Kr = 0.1  Le = 17.58 ft

## AQUIFER DATA

Saturated Thickness: 24.7ft (Kz/Kr): 0.1

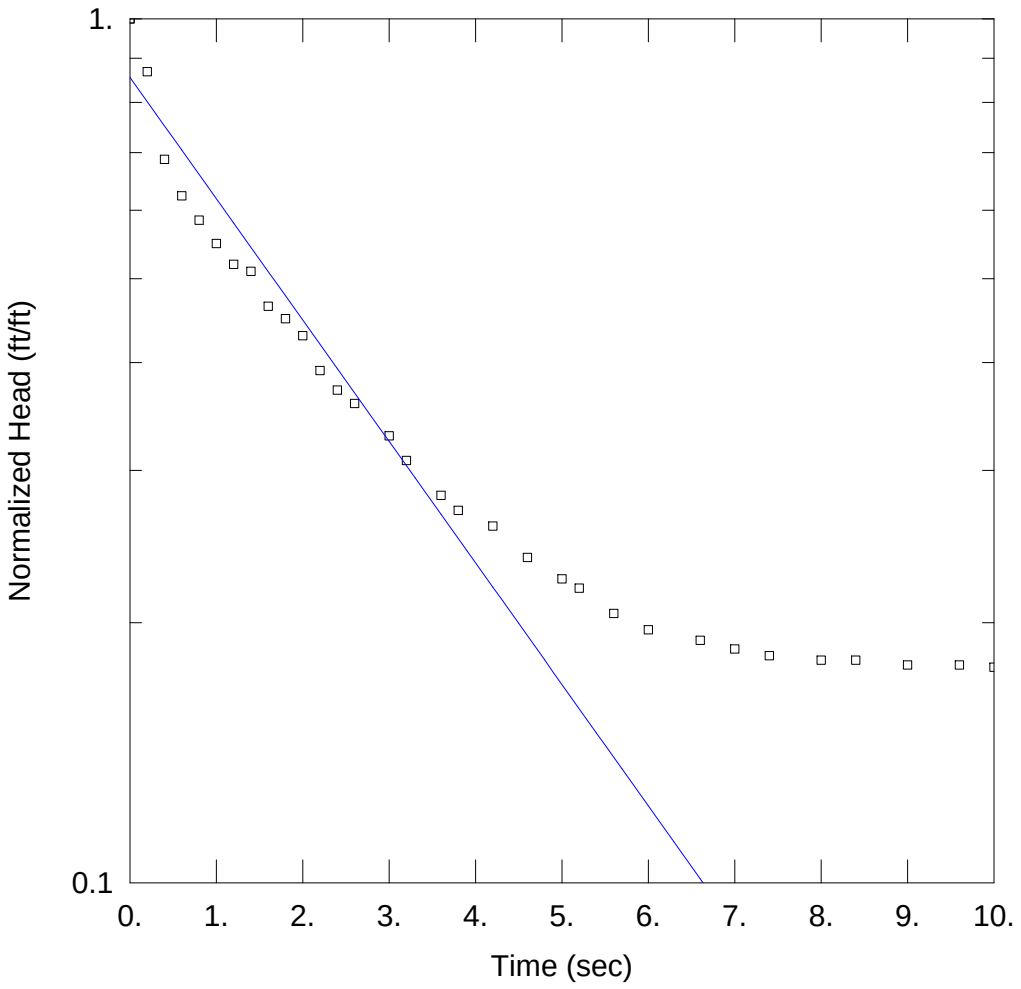
### WELL DATA (VAP-VRTB-02_36.6-40_50")

Initial Displacement: 2.934 ft
Static Water Column Height: 24.7 ft
Total Well Penetration Depth: 24.7 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-03 19.6-23

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.01 cm/sec  y0 = 0.78 ft

## AQUIFER DATA

Saturated Thickness: 7.5 ft (Kz/Kr): 1.

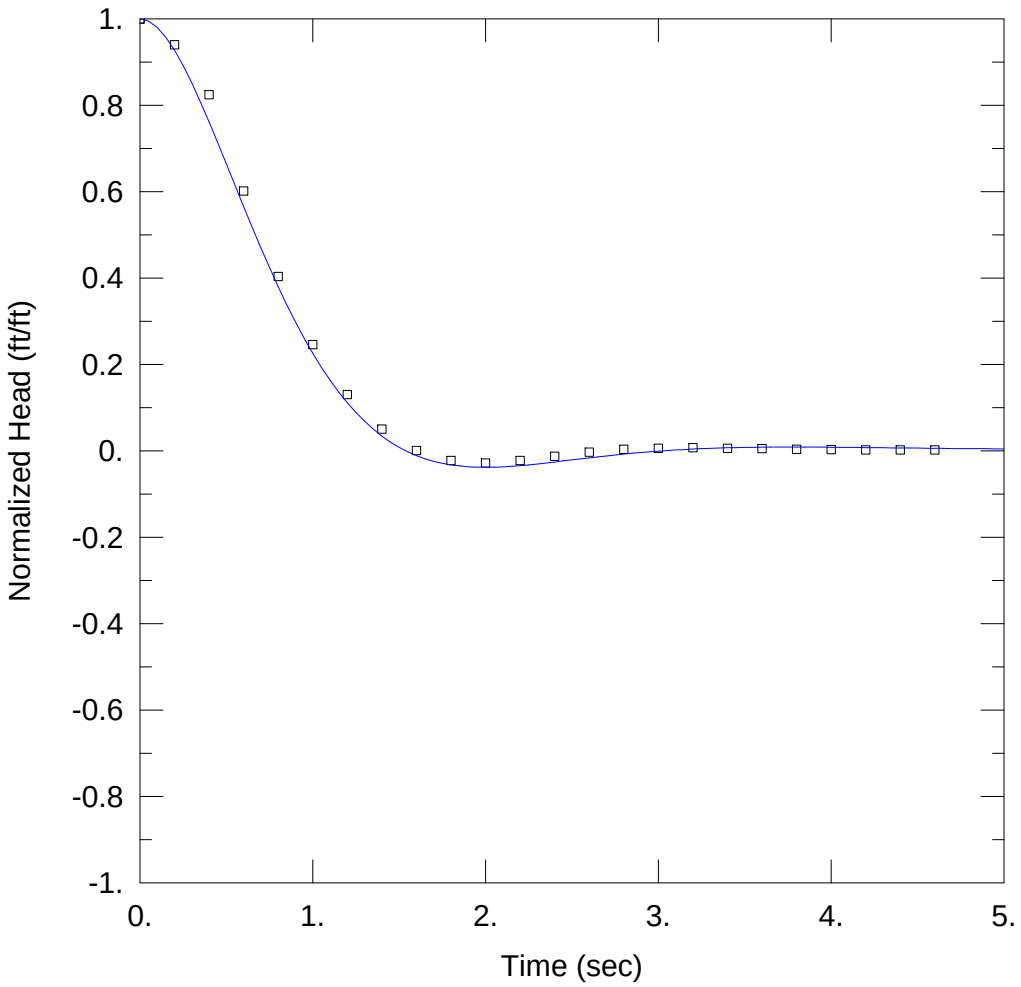
### WELL DATA (VAP-VRTB-03_19.6-23_30")

Initial Displacement: 0.912 ft
Static Water Column Height: 7.5 ft
Total Well Penetration Depth: 7.5 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-03 23.6-27

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.027 cm/sec  Ss = 1.1E-6 $ft^{-1}$
Kz/Kr = 0.1  Le = 7.4 ft

## AQUIFER DATA

Saturated Thickness: 11.5ft (Kz/Kr): 0.1

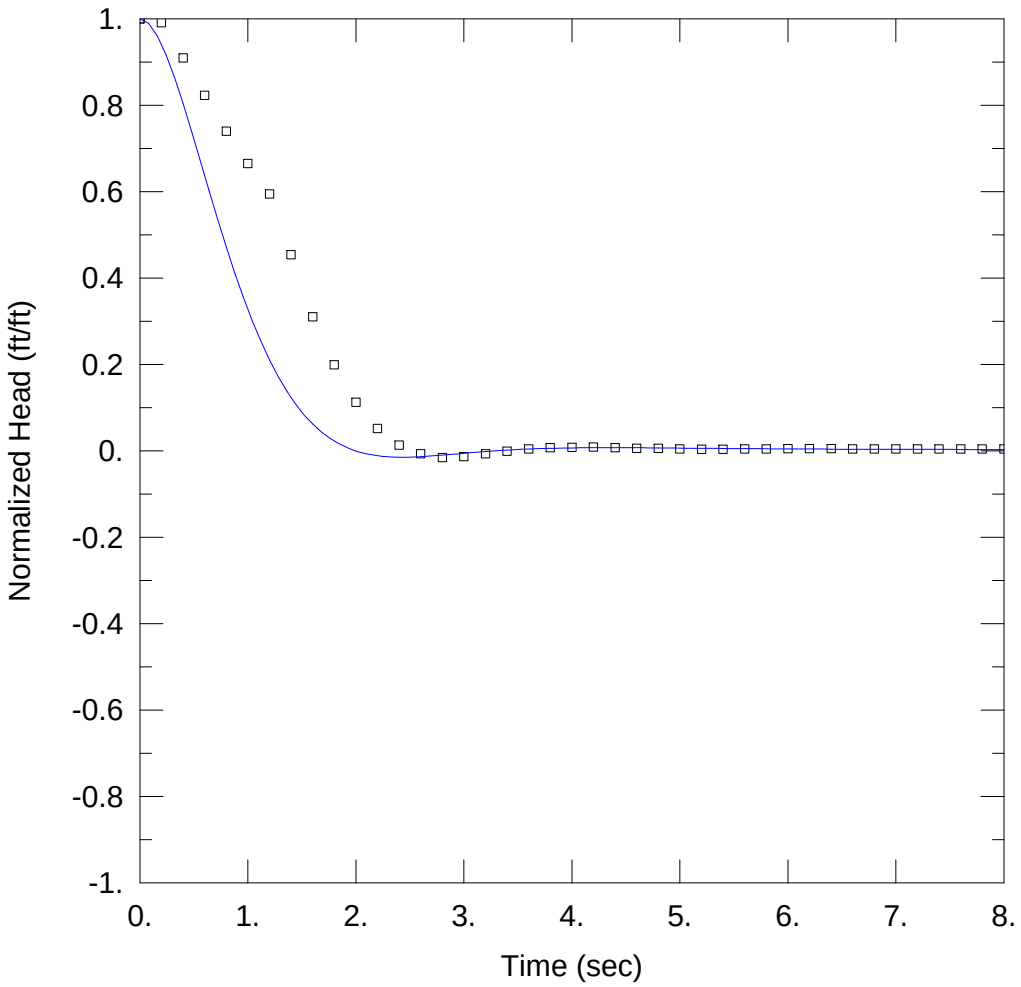
### WELL DATA (VAP-VRTB-03_23.6-27_30")

Initial Displacement: 1.38 ft
Static Water Column Height: 11.5 ft
Total Well Penetration Depth: 11.5 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-03 23.6-27

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.022 cm/sec  Ss = 1.1E-6 $ft^{-1}$
Kz/Kr = 0.1  Le = 9.17 ft

## AQUIFER DATA

Saturated Thickness: 11.5ft (Kz/Kr): 0.1

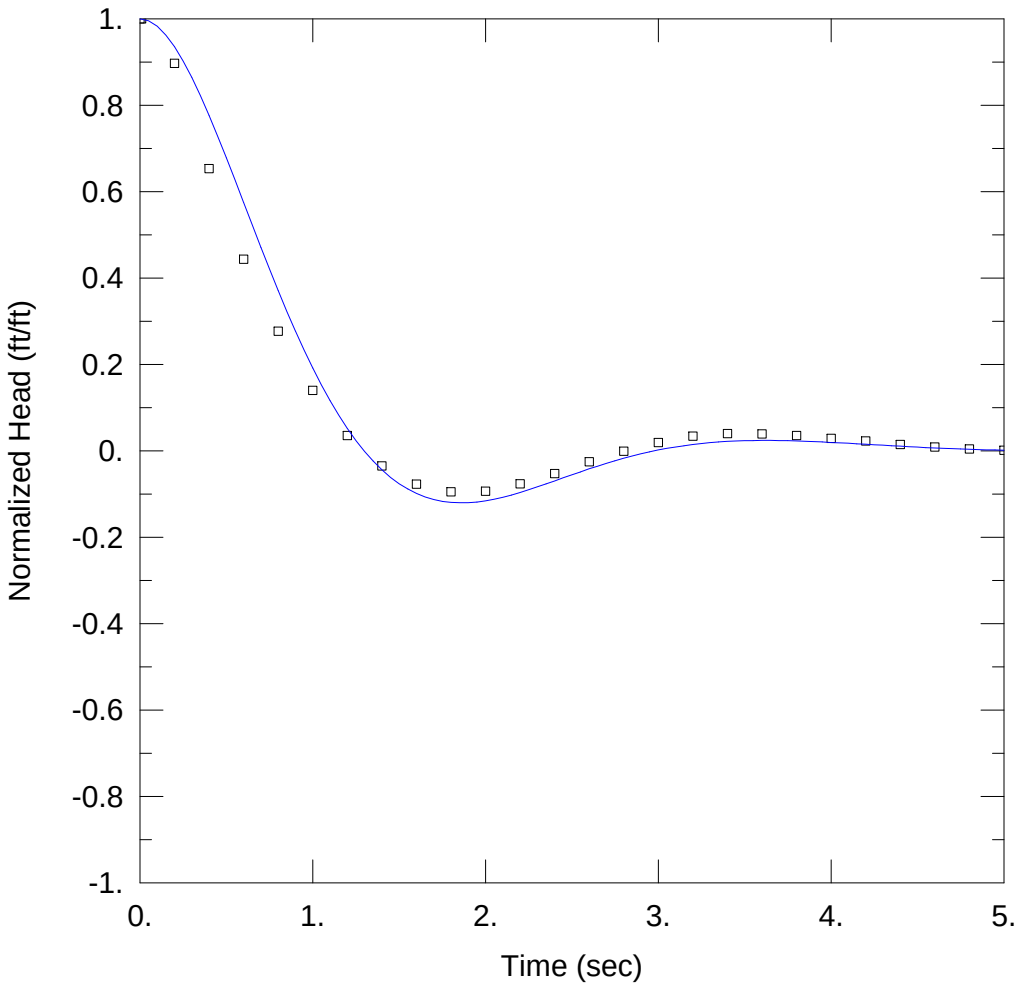
### WELL DATA (VAP-VRTB-03_23.6-27_50")

Initial Displacement: 1.911 ft
Static Water Column Height: 11.5 ft
Total Well Penetration Depth: 11.5 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-03 28.1-31.5

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.032 cm/sec  Ss = 7.3E-6 $ft^{-1}$
Kz/Kr = 0.1  Le = 8.75 ft

## AQUIFER DATA

Saturated Thickness: 16. ft (Kz/Kr): 0.1

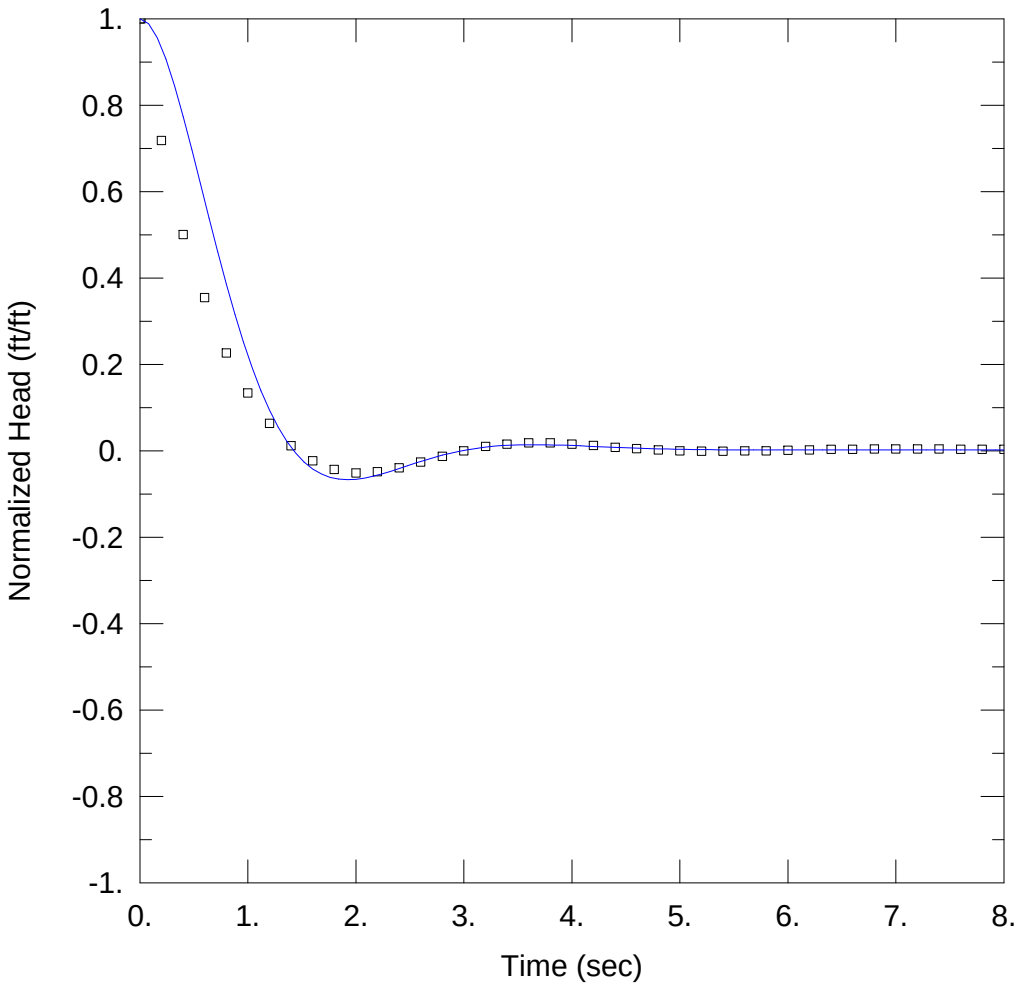
### WELL DATA (VAP-VRTB-03_28.1-31.5_30")

Initial Displacement: 1.159 ft
Static Water Column Height: 16. ft
Total Well Penetration Depth: 16. ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-03 28.1-31.5

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.028 cm/sec  Ss = 7.3E-6 $ft^{-1}$
Kz/Kr = 0.1  Le = 8.36 ft

## AQUIFER DATA

Saturated Thickness: 16. ft (Kz/Kr): 0.1

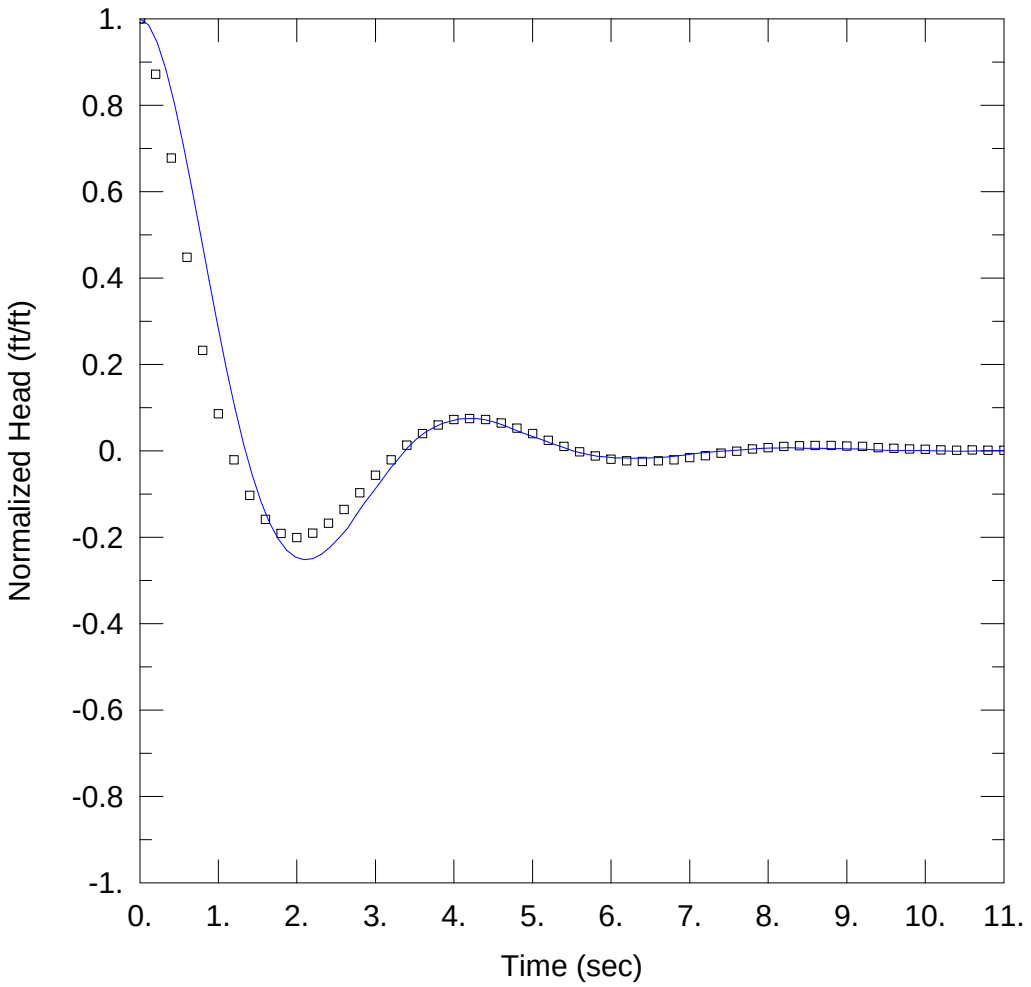
### WELL DATA (VAP-VRTB-03_28.1-31.5_50")

Initial Displacement: 2.354 ft
Static Water Column Height: 16. ft
Total Well Penetration Depth: 16. ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-03 32.6-36

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.038 cm/sec  Ss = 1.5E-5 $ft^{-1}$
Kz/Kr = 0.1  Le = 13.04 ft

## AQUIFER DATA

Saturated Thickness: 20.5ft (Kz/Kr): 0.1

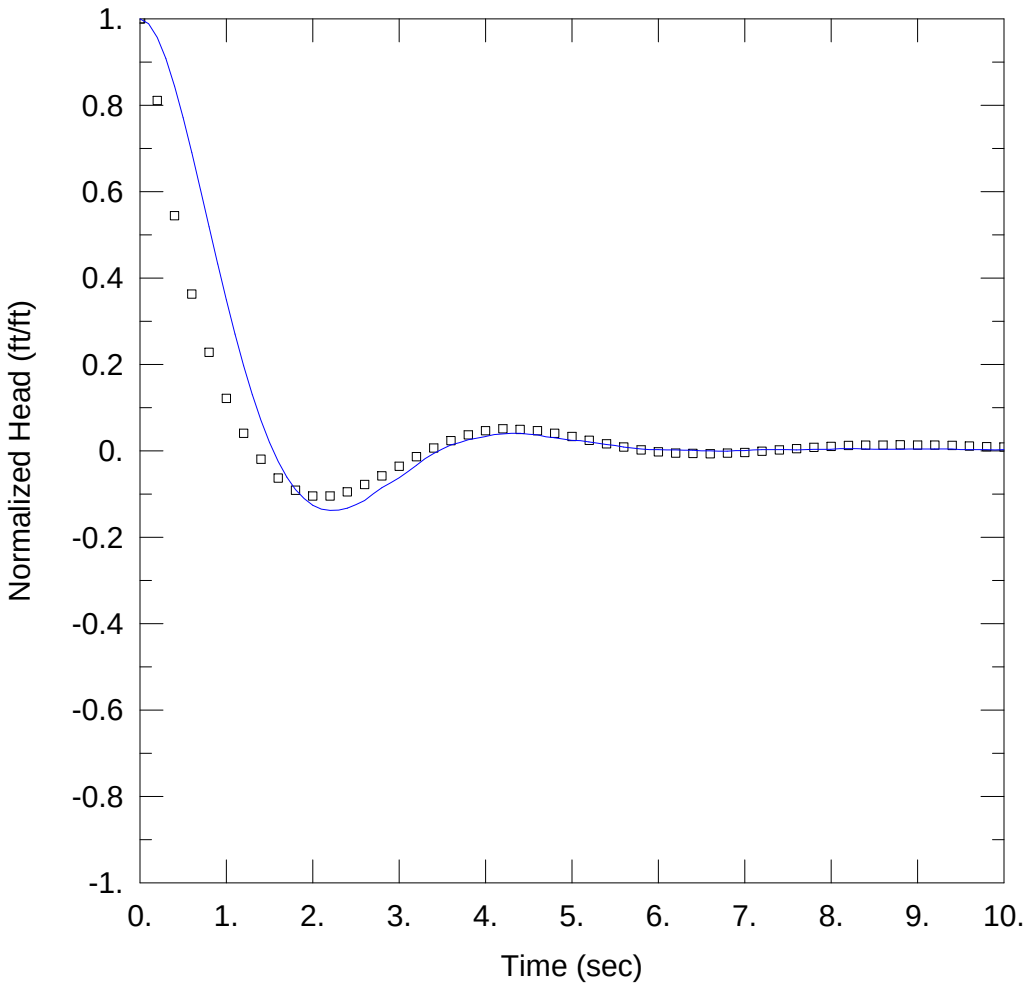
### WELL DATA (VAP-VRTB-03_32.6-36_30")

Initial Displacement: 1.246 ft
Static Water Column Height: 20.5 ft
Total Well Penetration Depth: 20.5 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP=VRTB-03 32.6-36

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.025 cm/sec  Ss = 4.2E-5 $ft^{-1}$
Kz/Kr = 0.1  Le = 13.64 ft

## AQUIFER DATA

Saturated Thickness: 20.5ft (Kz/Kr): 0.1

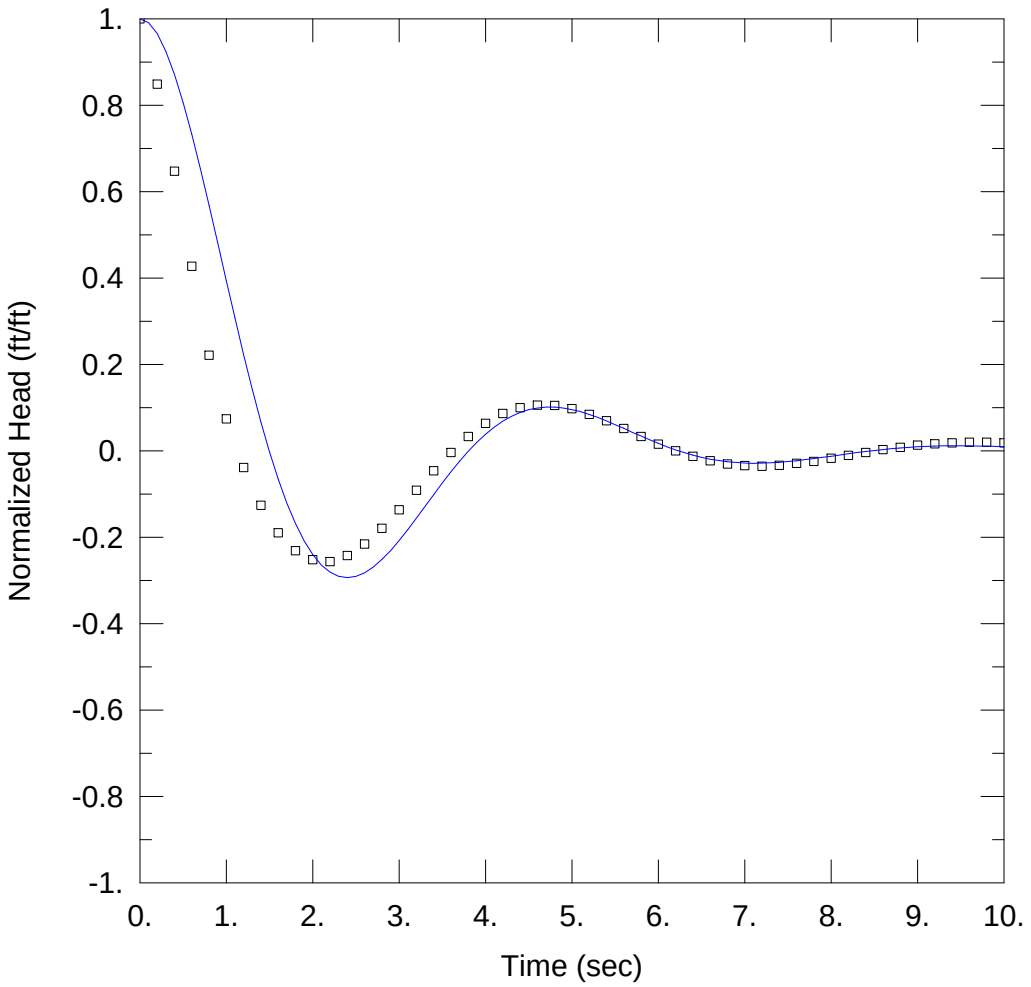
### WELL DATA (VAP-VRTB-03_32.6-36_50")

Initial Displacement: 2.422 ft
Static Water Column Height: 20.5 ft
Total Well Penetration Depth: 20.5 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-03 36.6-40

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.033 cm/sec  Ss = 7.9E-5 $ft^{-1}$
Kz/Kr = 0.3  Le = 17.5 ft

## AQUIFER DATA

Saturated Thickness: 24.5ft (Kz/Kr): 0.3

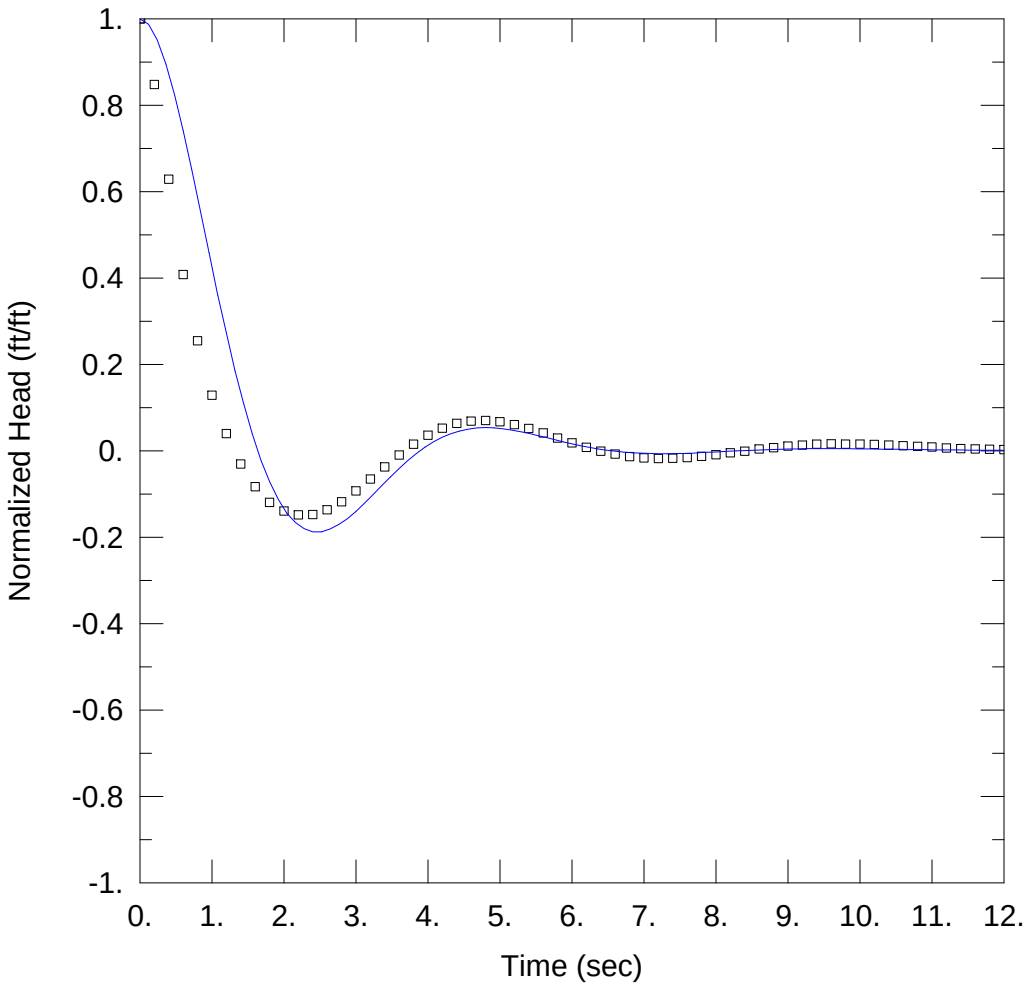
### WELL DATA (VAP-VRTB-03_36.6-40_30")

Initial Displacement: 1.58 ft
Static Water Column Height: 24.5 ft
Total Well Penetration Depth: 24.5 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-03 36.6-40

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.024 cm/sec  Ss = 8.0E-5 $ft^{-1}$
Kz/Kr = 0.3  Le = 17.4 ft

## AQUIFER DATA

Saturated Thickness: 24.5ft (Kz/Kr): 0.3

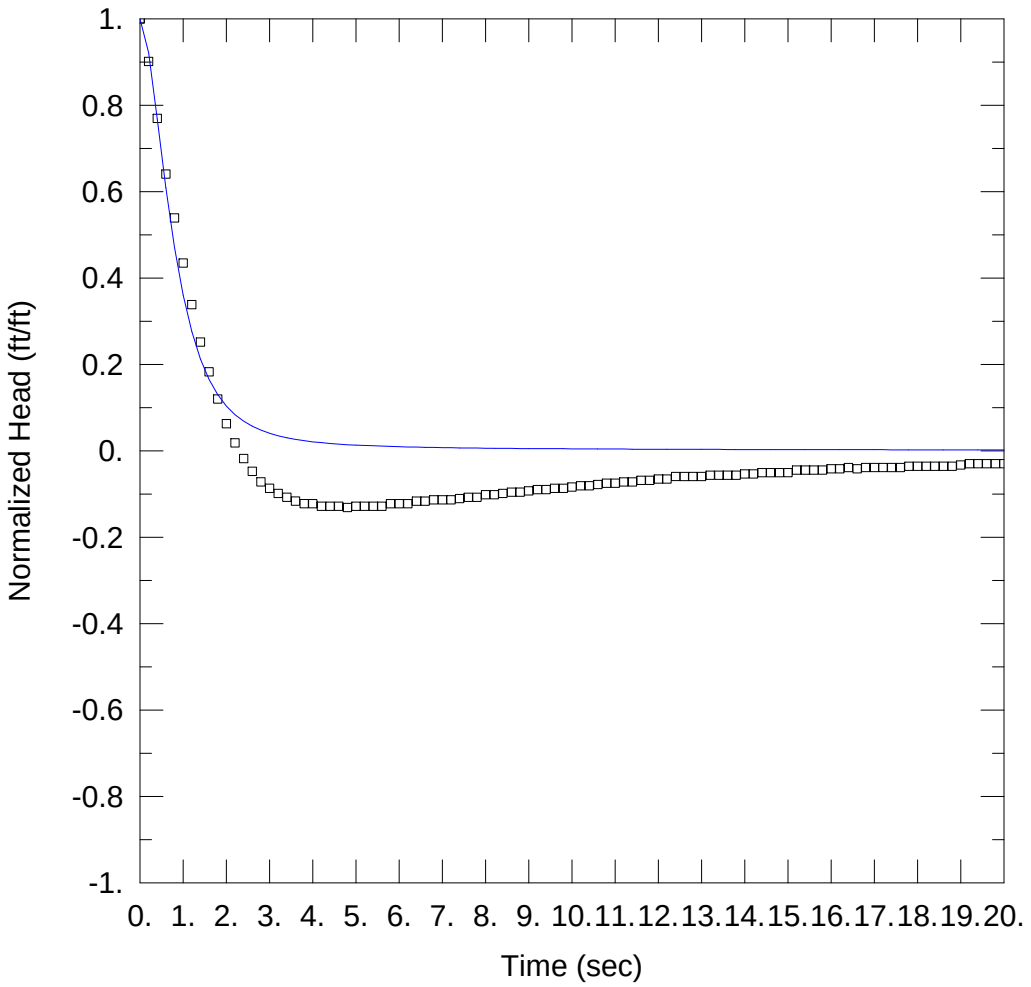
### WELL DATA (VAP-VRTB-03_36.6-40_50")

Initial Displacement: 2.966 ft
Static Water Column Height: 24.5 ft
Total Well Penetration Depth: 24.5 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-04 20.1-23.5

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.016 cm/sec  Ss = 1.4E-6 $ft^{-1}$
Kz/Kr = 0.5  Le = 6.186 ft

## AQUIFER DATA

Saturated Thickness: 8.3 ft (Kz/Kr): 0.5

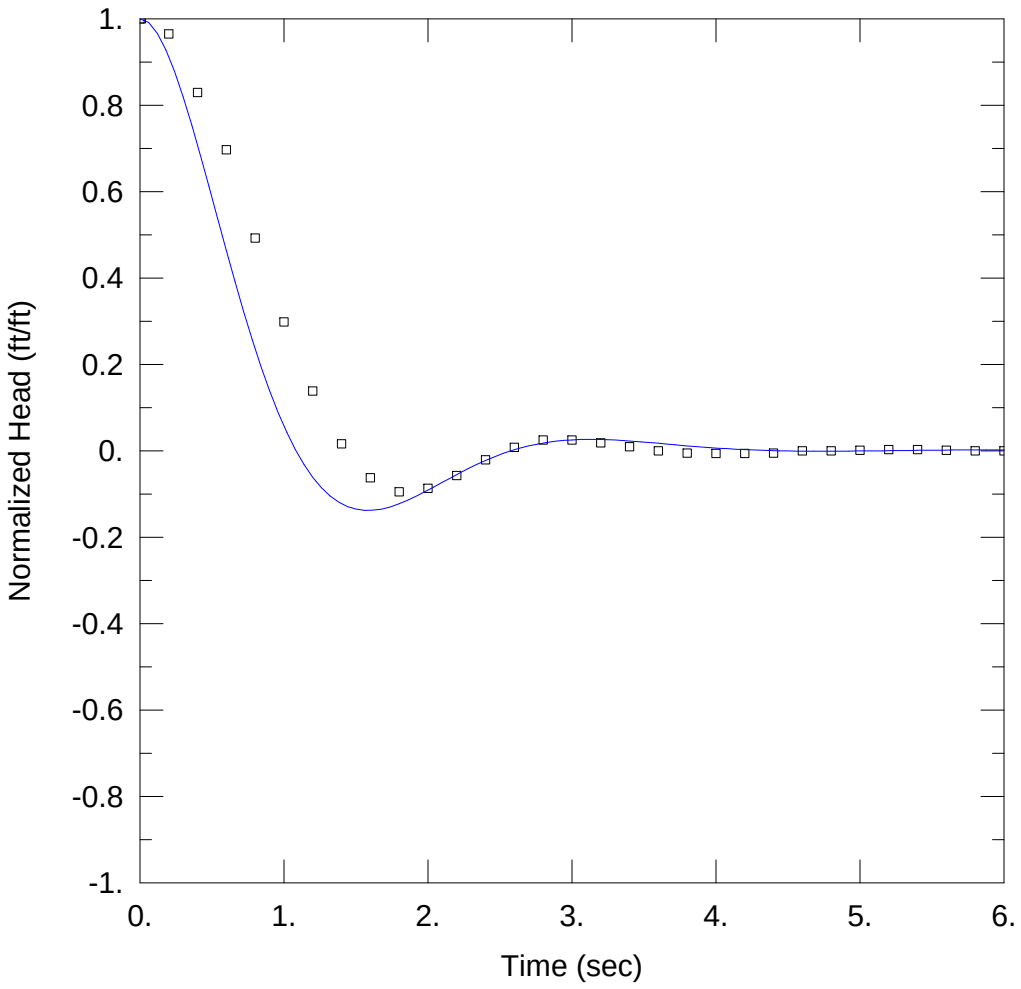
### WELL DATA (VAP-VRTB-04_20.1-23.5_30")

Initial Displacement: 0.334 ft
Static Water Column Height: 8.3 ft
Total Well Penetration Depth: 8.3 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-04 24.1-27.5

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.04 cm/sec  Ss = 2.0E-6 $ft^{-1}$
Kz/Kr = 0.1  Le = 6.3 ft

## AQUIFER DATA

Saturated Thickness: 12.3ft (Kz/Kr): 0.1

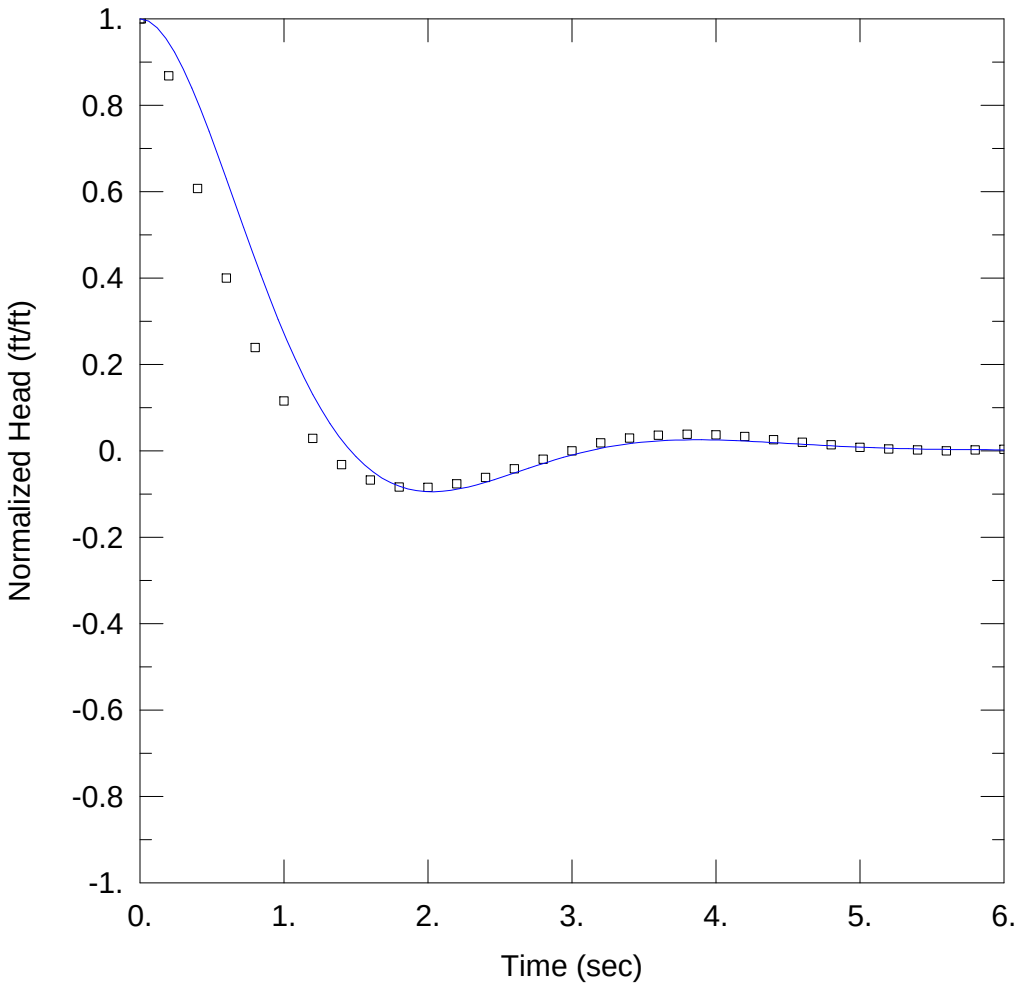
### WELL DATA (VAP-VRTB-04_24.1-27.5_30")

Initial Displacement: 0.768 ft
Static Water Column Height: 12.3 ft
Total Well Penetration Depth: 12.3 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-04 29.6-33

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.026 cm/sec  Ss = 2.3E-5 $ft^{-1}$
Kz/Kr = 0.1  Le = 10.45 ft

## AQUIFER DATA

Saturated Thickness: 17.8ft (Kz/Kr): 0.1

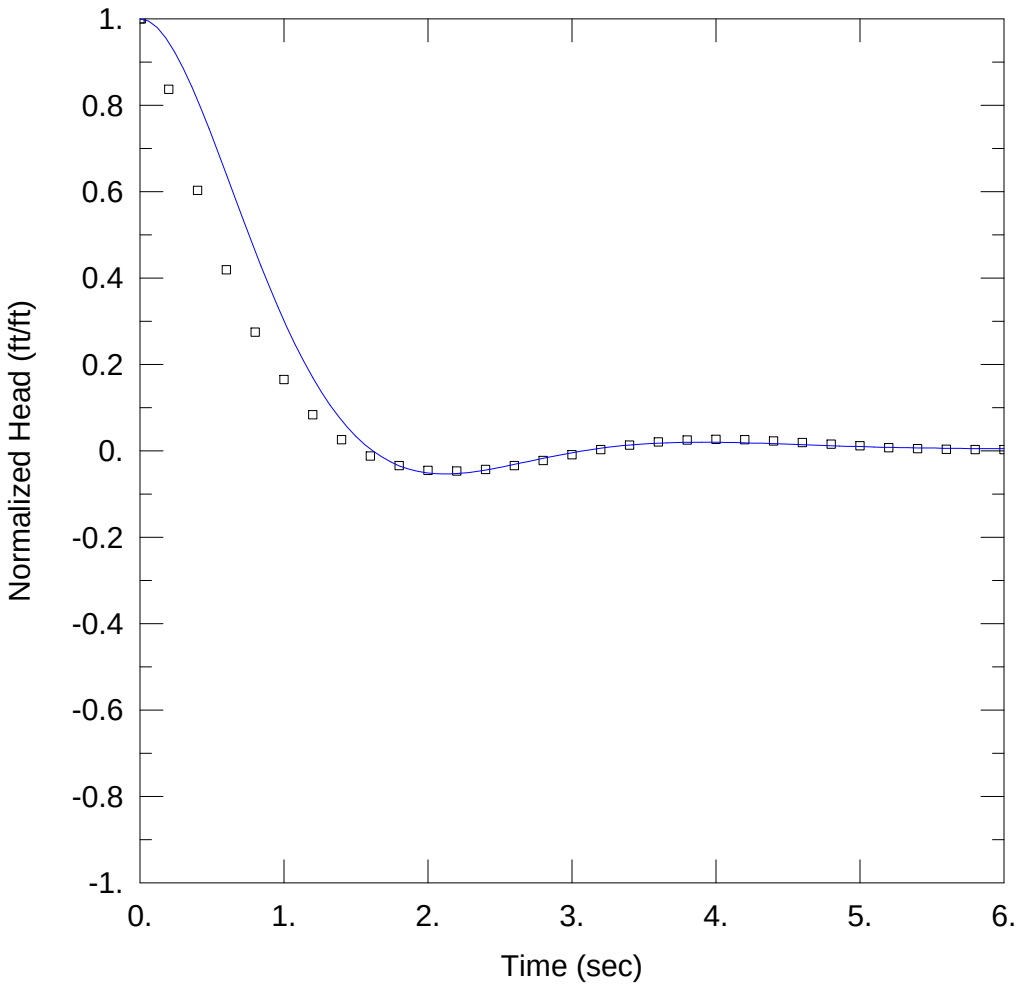
### WELL DATA (VAP-VRTB-04_29.6-33_30")

Initial Displacement: 1.274 ft
Static Water Column Height: 17.8 ft
Total Well Penetration Depth: 17.8 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-04 29.6-33

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.023 cm/sec  Ss = 2.3E-5 $ft^{-1}$
Kz/Kr = 0.1  Le = 10.45 ft

## AQUIFER DATA

Saturated Thickness: 17.8ft (Kz/Kr): 0.1

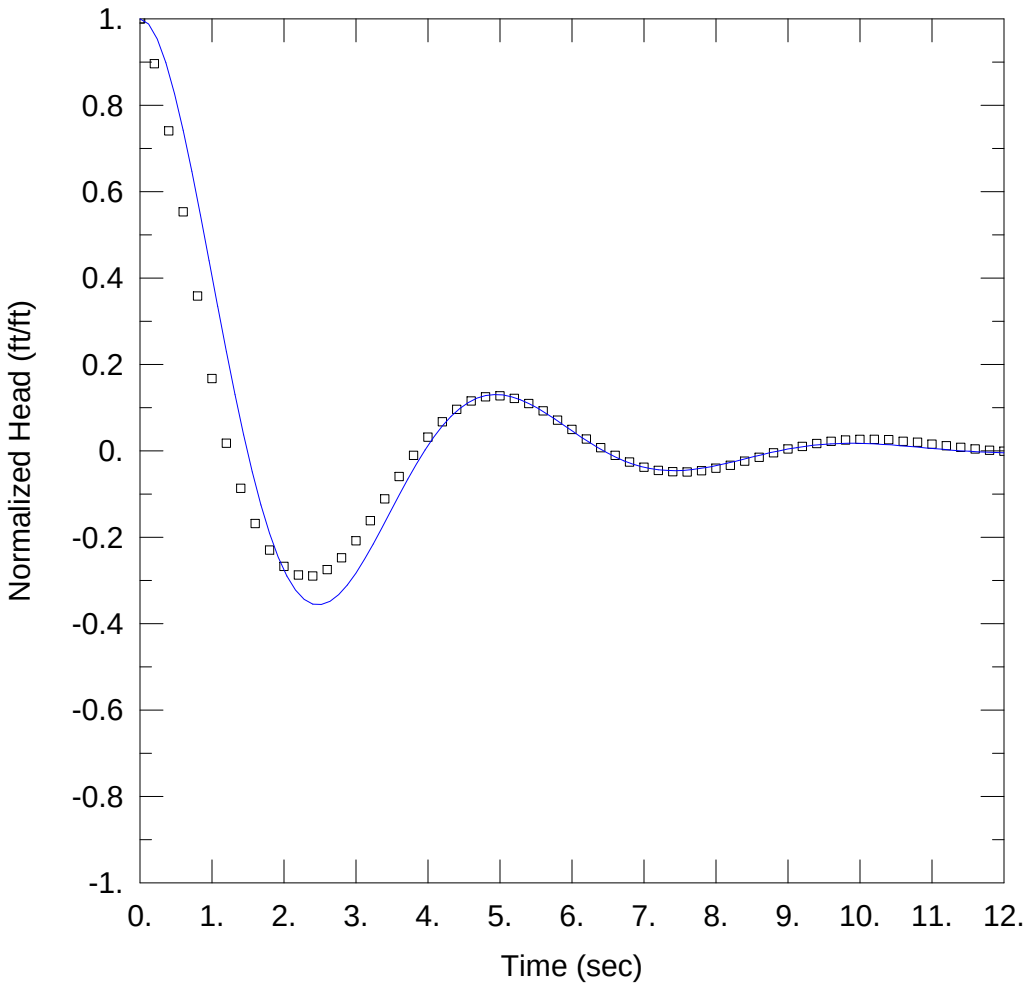
### WELL DATA (VAP-VRTB-04_29.6-33_50")

Initial Displacement: 2.19 ft
Static Water Column Height: 17.8 ft
Total Well Penetration Depth: 17.8 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-04 36.6-40

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.048 cm/sec  Ss = 1.0E-6 $ft^{-1}$
Kz/Kr = 0.1  Le = 18.3 ft

## AQUIFER DATA

Saturated Thickness: 24.8ft (Kz/Kr): 0.1

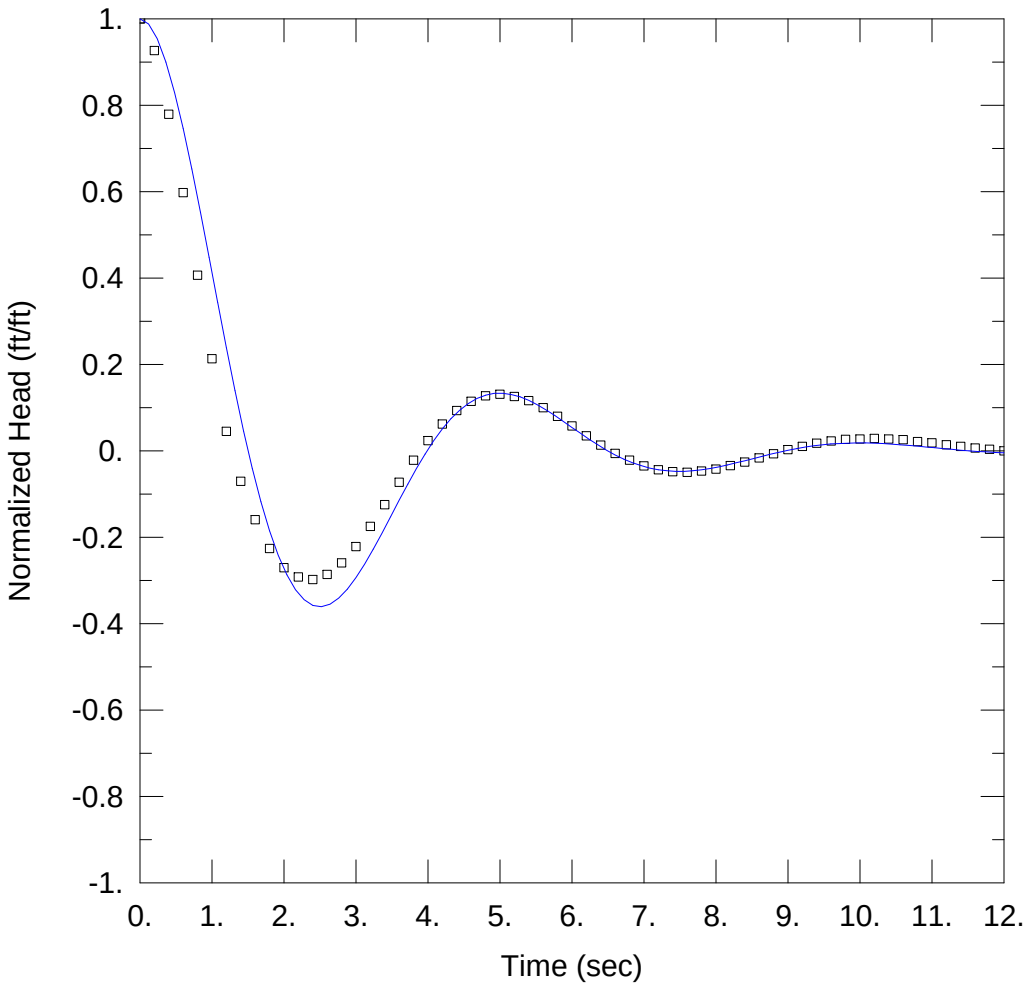
### WELL DATA (VAP-VRTB-04_36.6-40_30")

Initial Displacement: 1.576 ft
Static Water Column Height: 24.8 ft
Total Well Penetration Depth: 24.8 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# VAP-VRTB-04 36.6-40

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: Butler-Zhan

Kr = 0.048 cm/sec  Ss = 1.0E-6 $ft^{-1}$
Kz/Kr = 0.1  Le = 18.7 ft

## AQUIFER DATA

Saturated Thickness: 24.8ft (Kz/Kr): 0.1

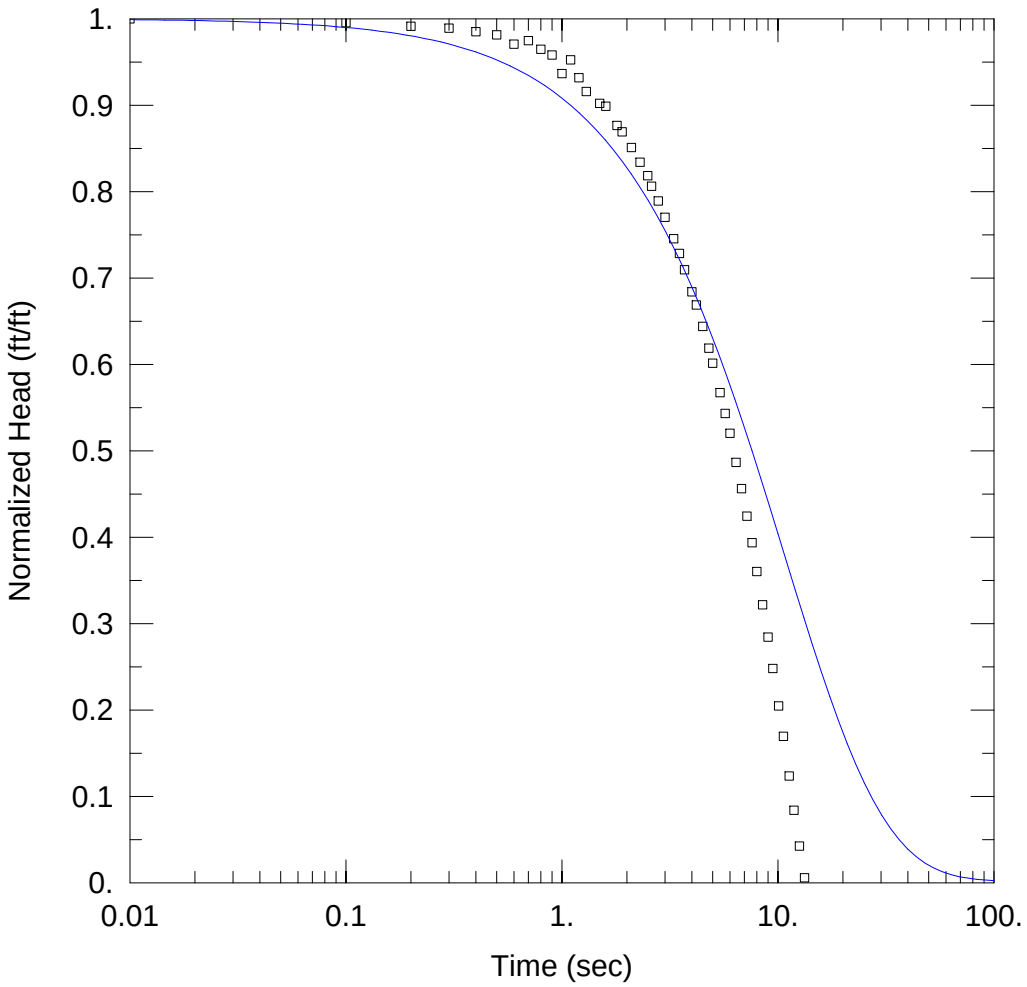
### WELL DATA (VAP-VRTB-04_36.6-40_50")

Initial Displacement: 1.501 ft
Static Water Column Height: 24.8 ft
Total Well Penetration Depth: 24.8 ft
Screen Length: 3.4 ft
Casing Radius: 0.02604 ft
Well Radius: 0.02604 ft

ARCADIS

# SB1 Falling Head Test 1

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0031 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

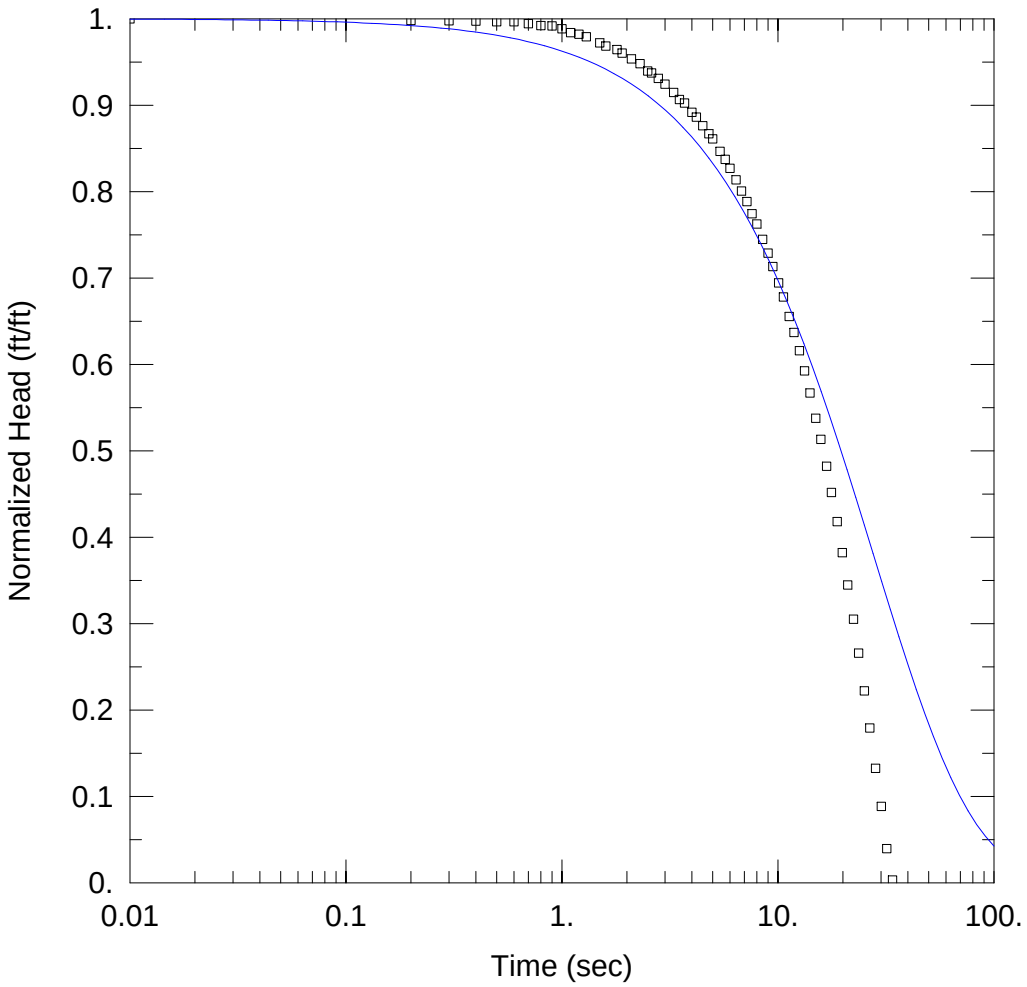
## WELL DATA (SB1)

Initial Displacement: 4.463 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# SG4 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0012 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

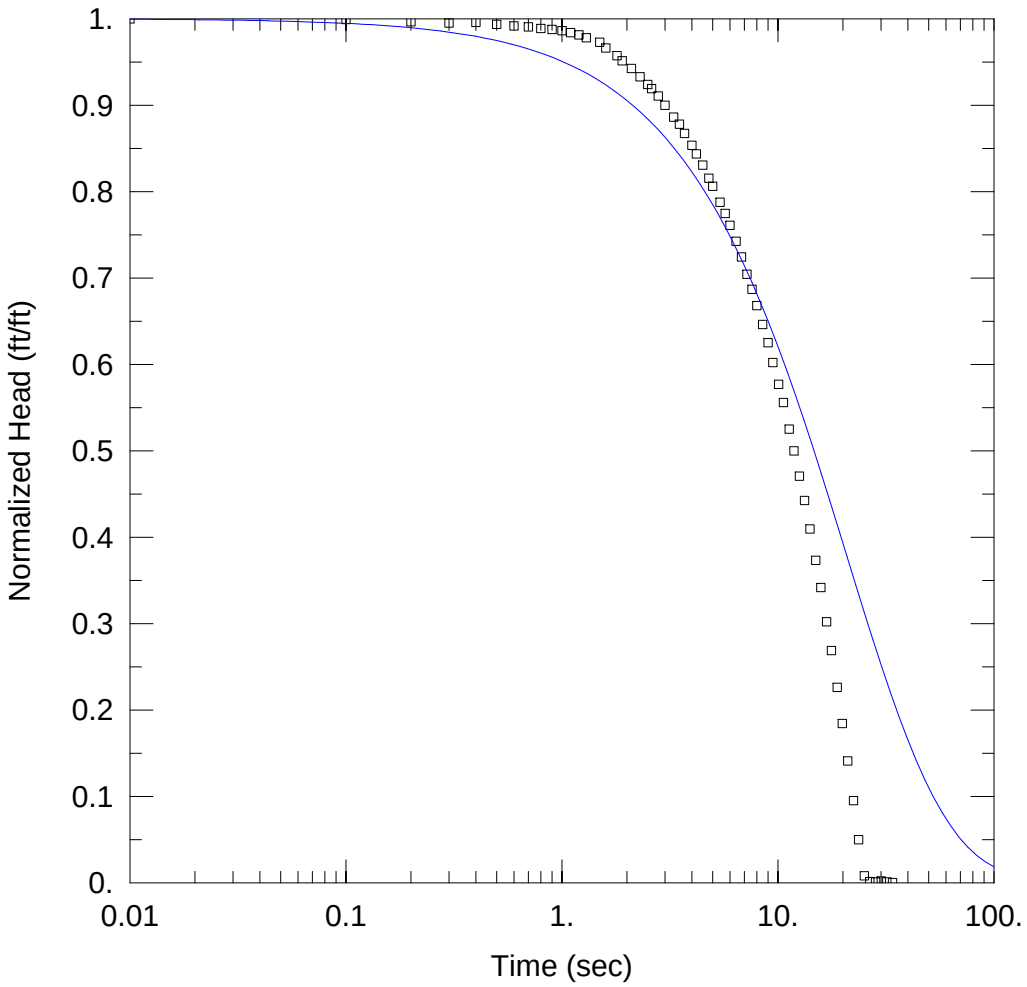
## WELL DATA (SG4)

Initial Displacement: 6.259 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# SM5 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0016 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

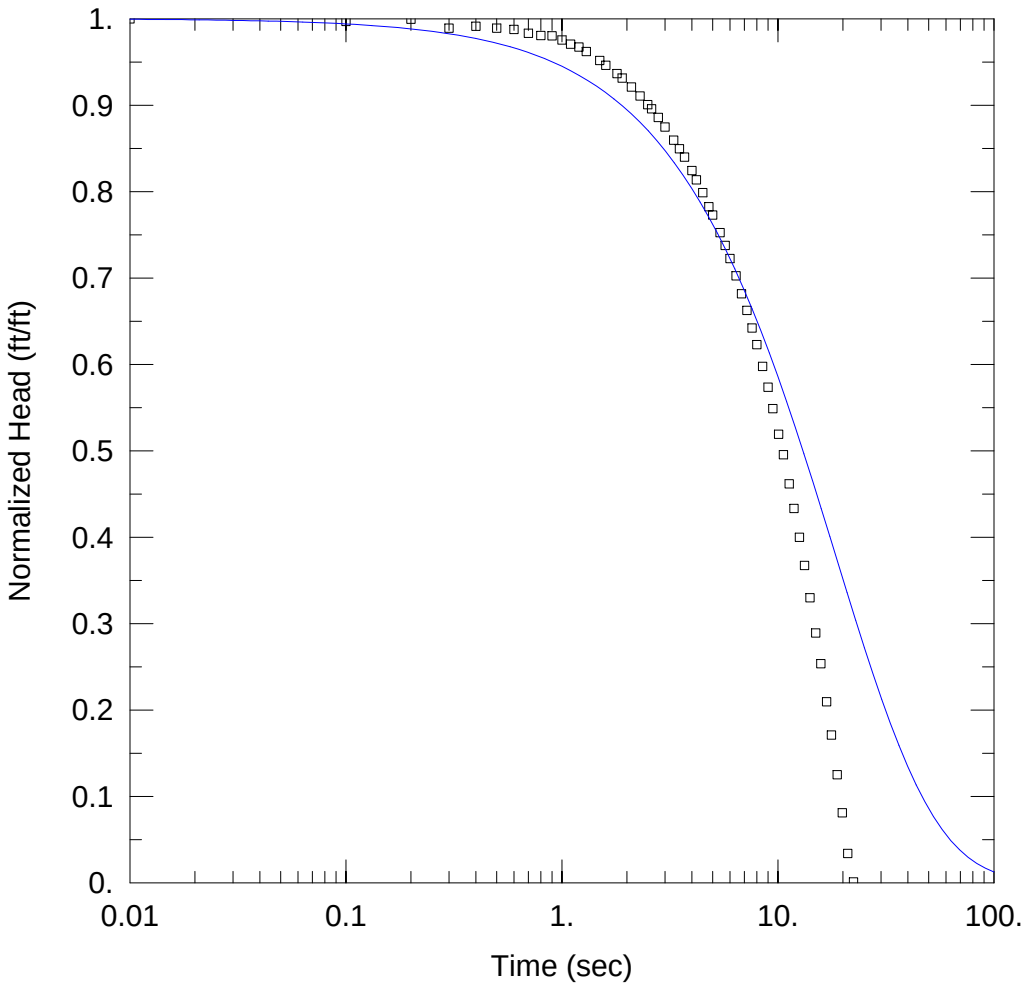
## WELL DATA (SM5)

Initial Displacement: 6.606 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# SO6 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0018 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

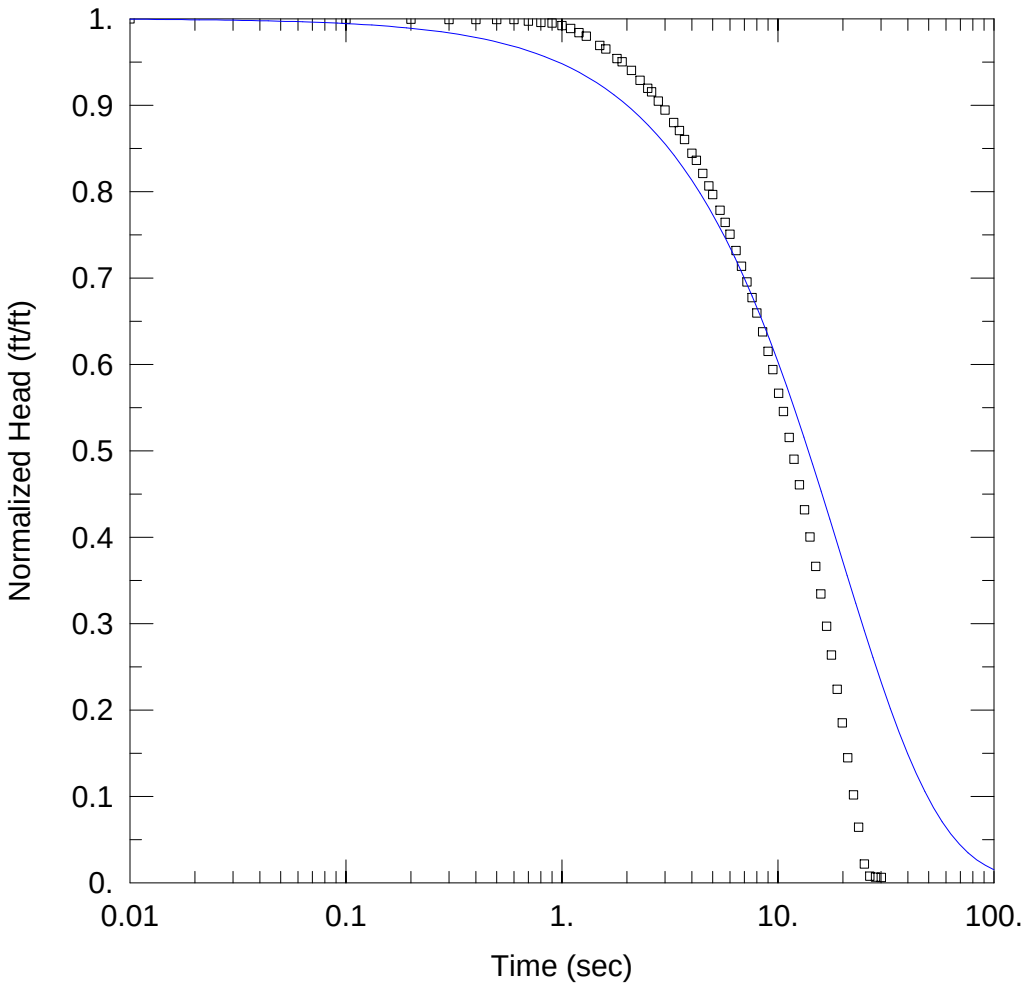
## WELL DATA (SO6)

Initial Displacement: 6.579 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# SP8 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0017 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

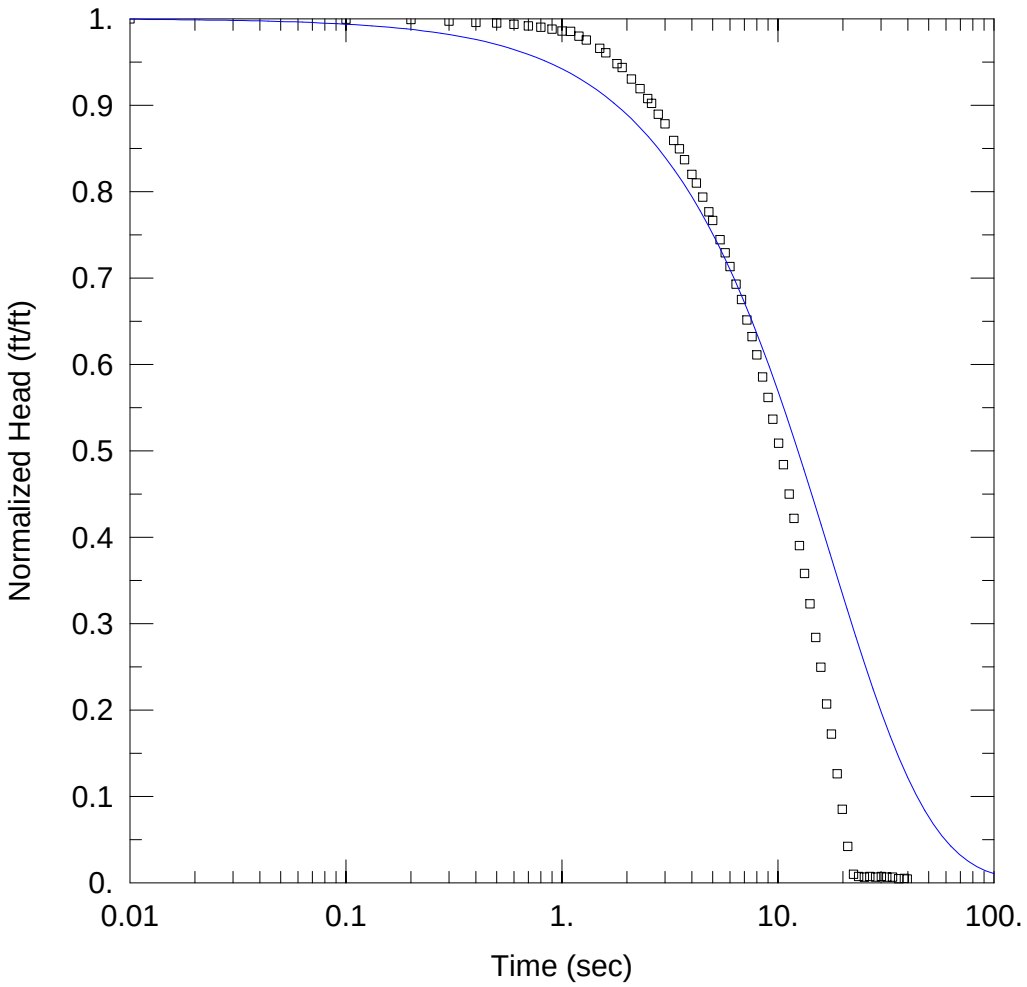
## WELL DATA (SP8)

Initial Displacement: 6.55 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# SR7 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0019 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

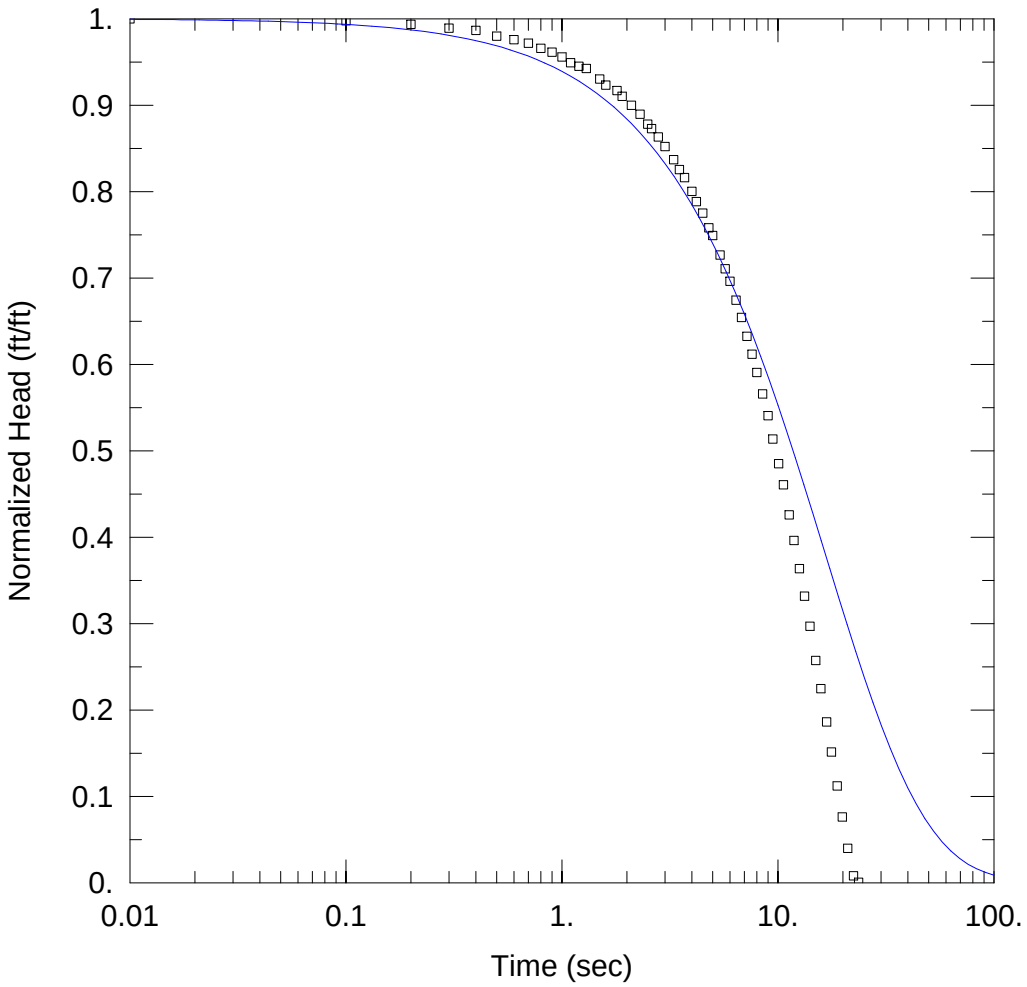
## WELL DATA (SR7)

Initial Displacement: 6.505 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# SS2 Falling Head Test 1

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.002 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

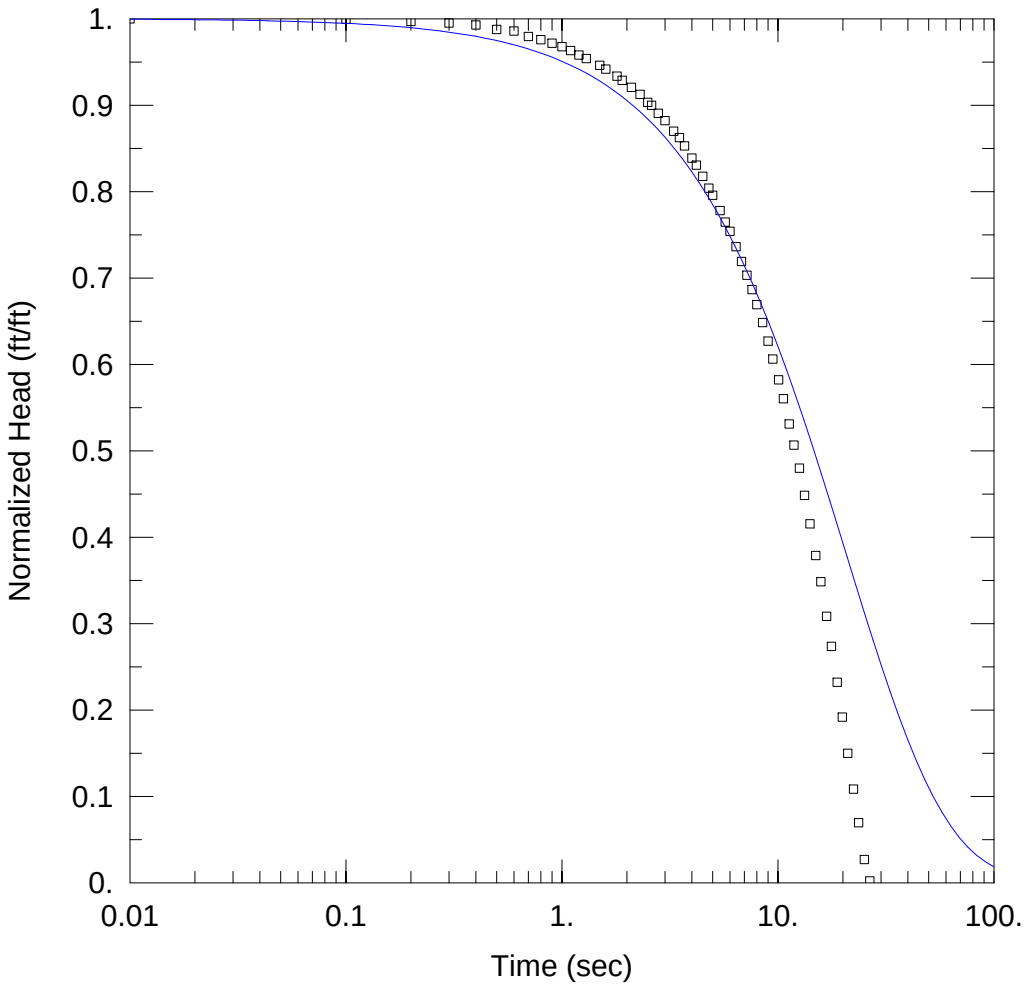
## WELL DATA (SS2)

Initial Displacement: 6.001 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# SY3 Falling Head Test 2

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0016 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

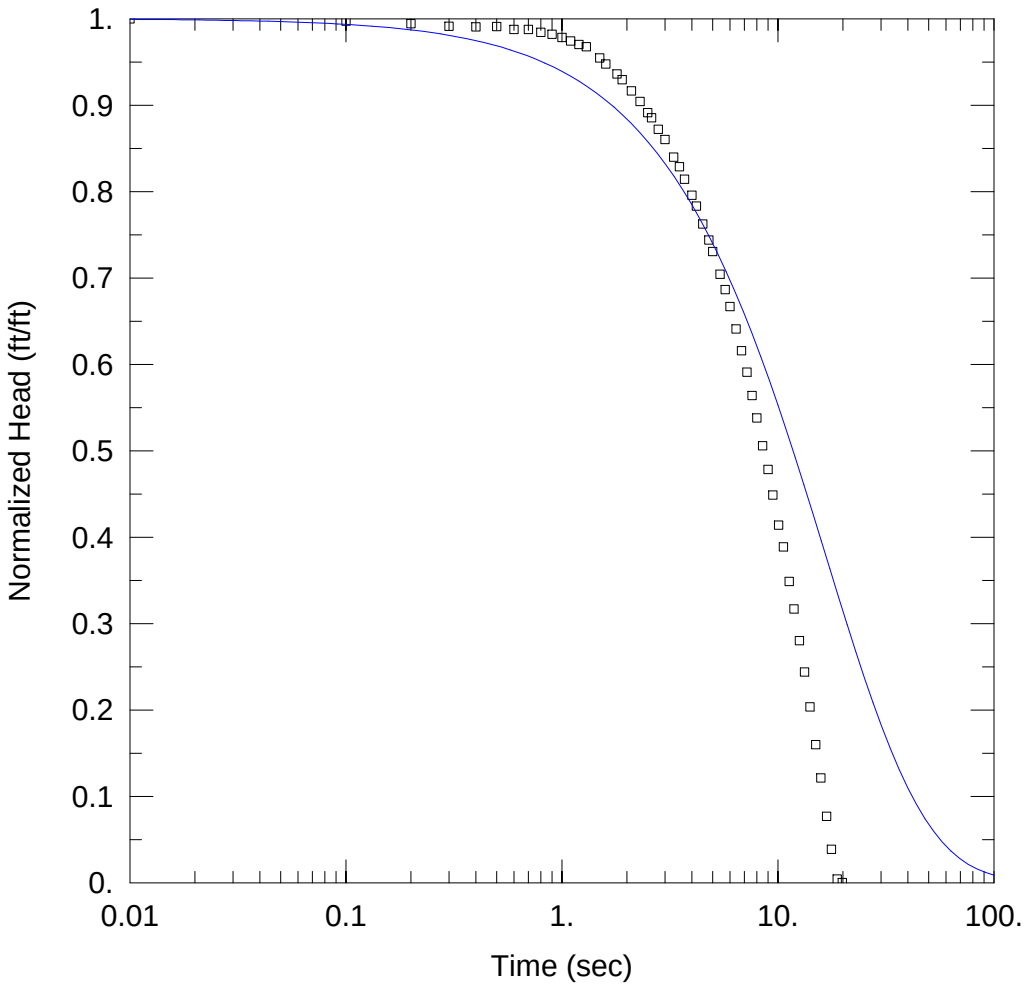
## WELL DATA (SY3)

Initial Displacement: 5.939 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DB1 Falling Head Test 2

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.002 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

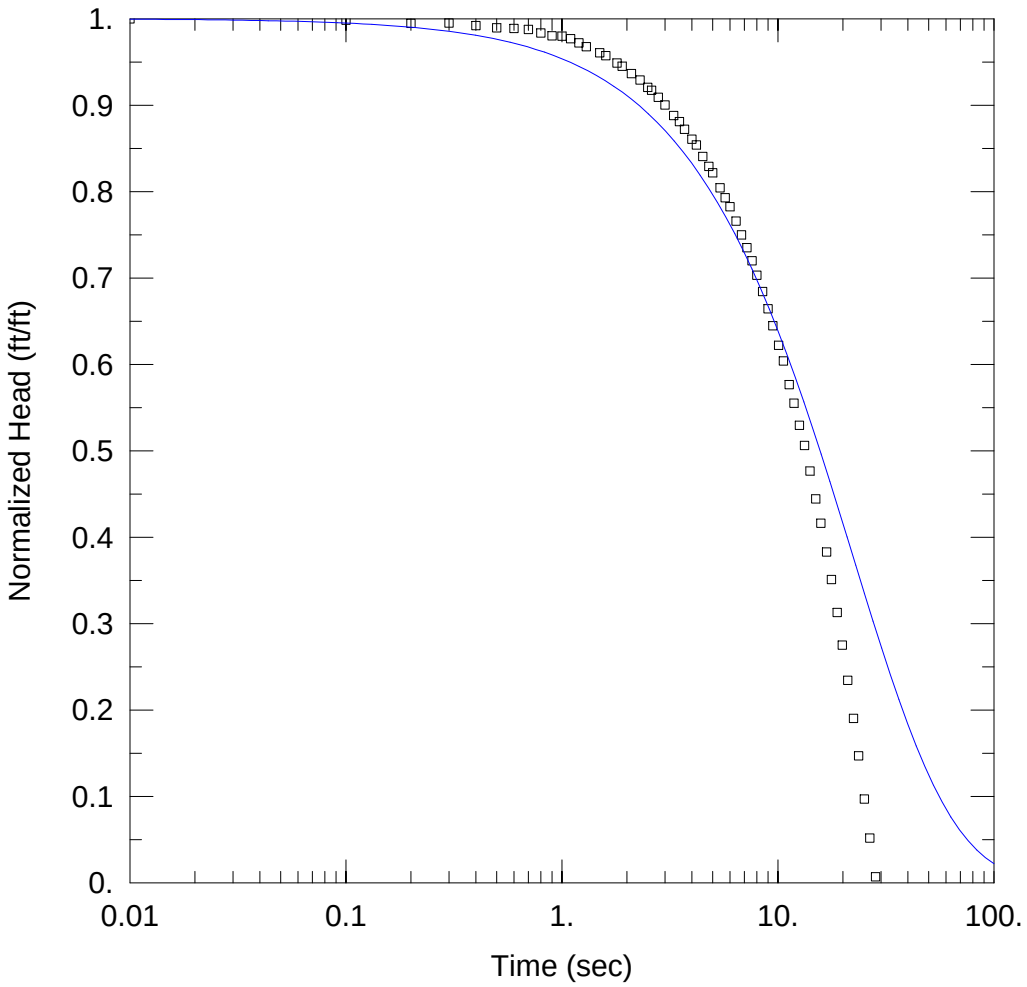
## WELL DATA (DB1)

Initial Displacement: 6.1 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DG4 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0015 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

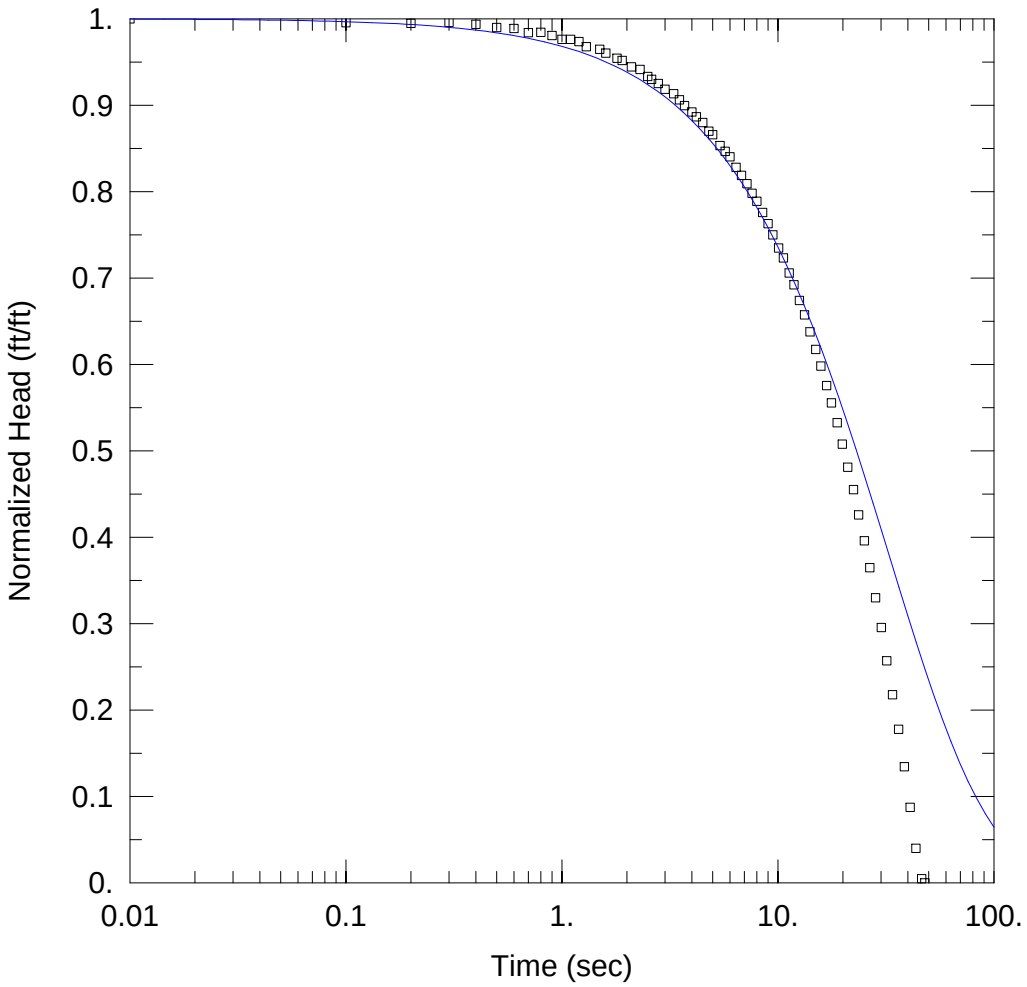
## WELL DATA (DG4)

Initial Displacement: 6.544 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DM5 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.001017 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

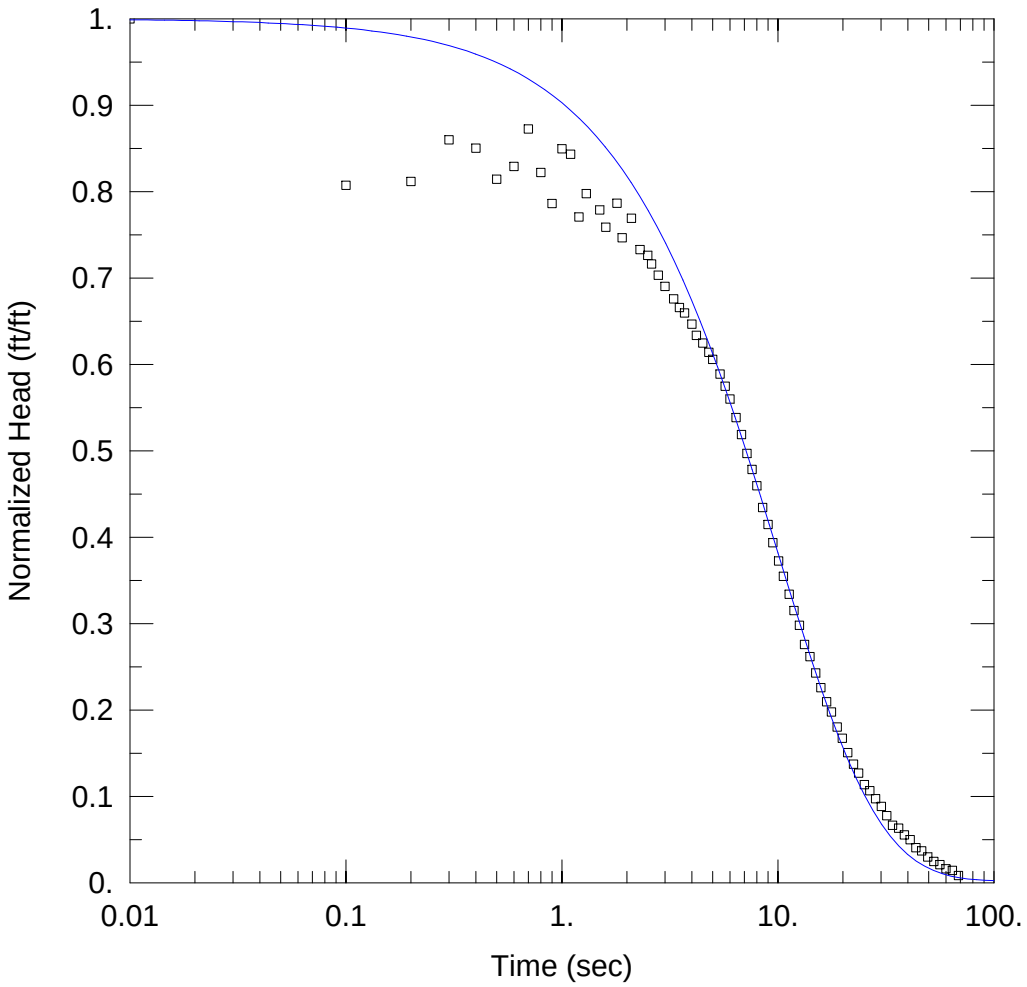
## WELL DATA (DM5)

Initial Displacement: 5.46 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DM5 Rising Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0033 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

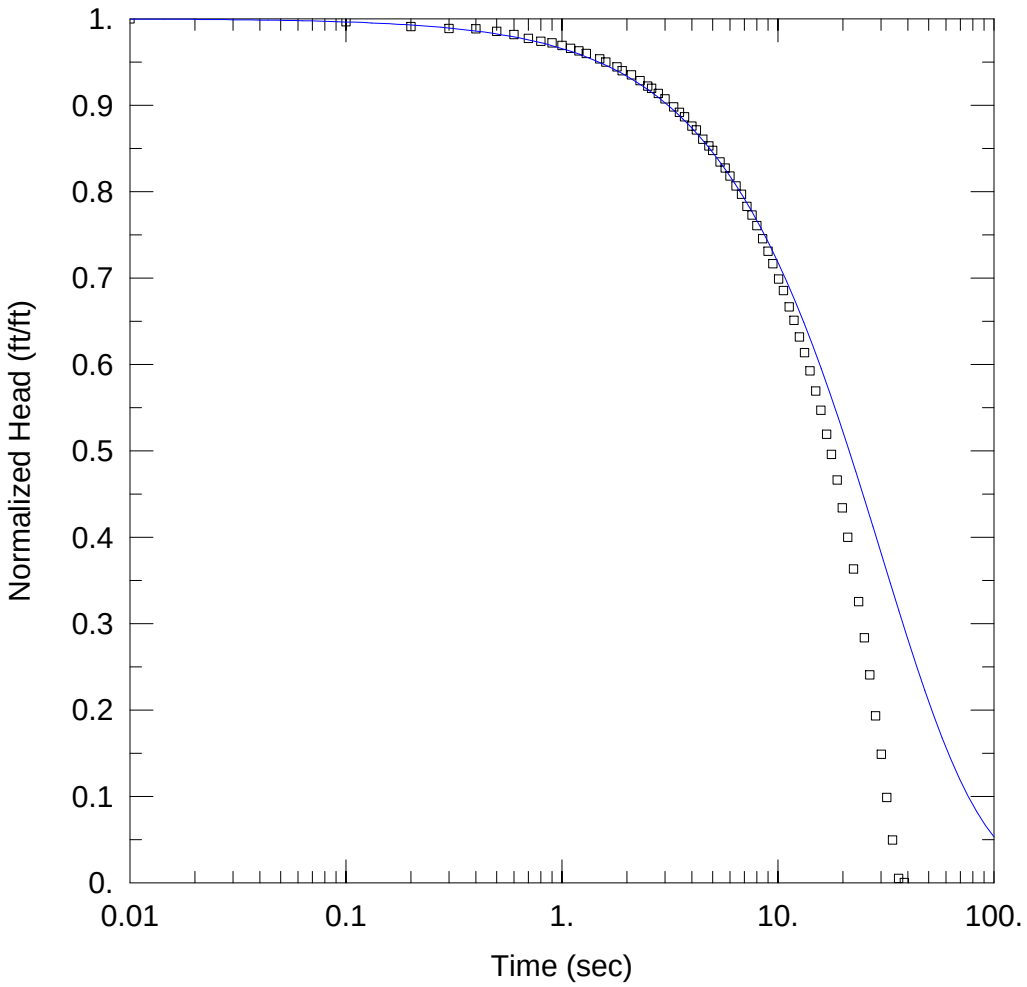
## WELL DATA (DM5)

Initial Displacement: 2.476 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DO6 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0011 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

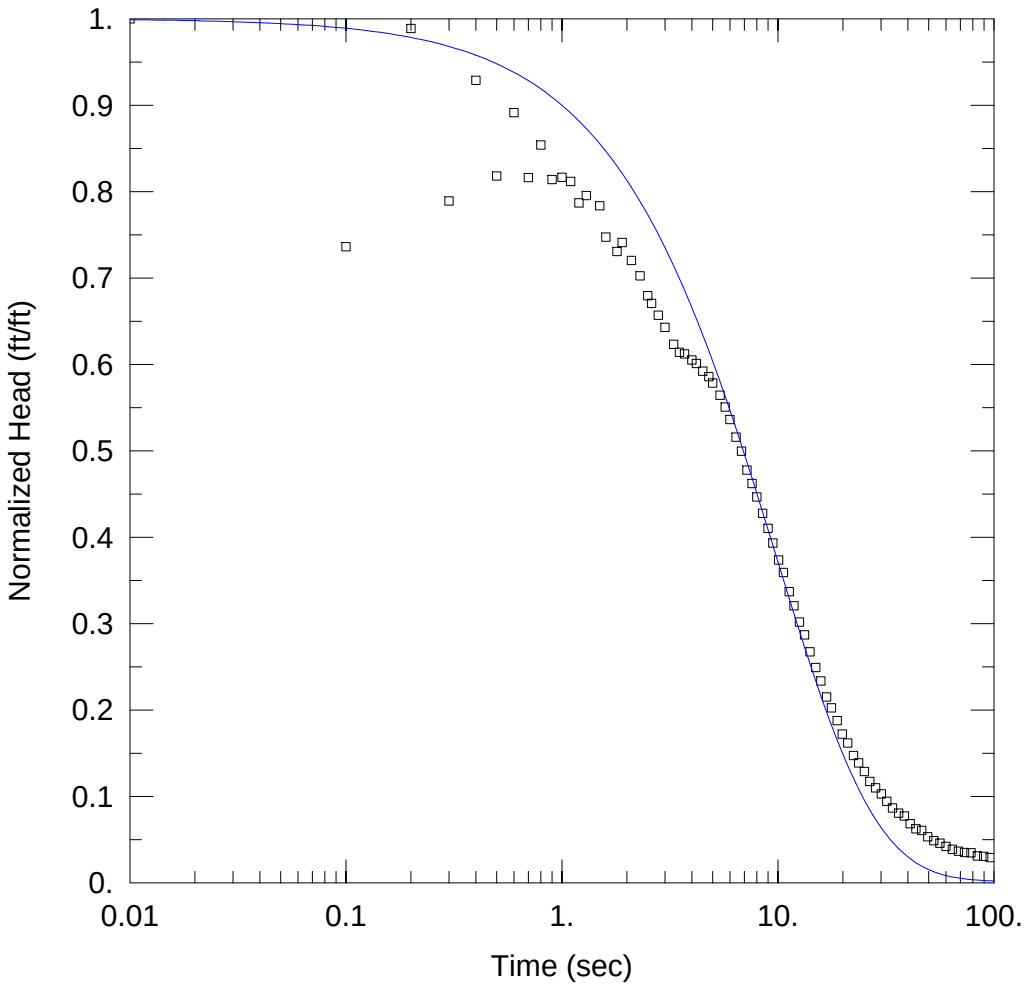
## WELL DATA (DO6)

Initial Displacement: 6.271 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DO6 Rising Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0034 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

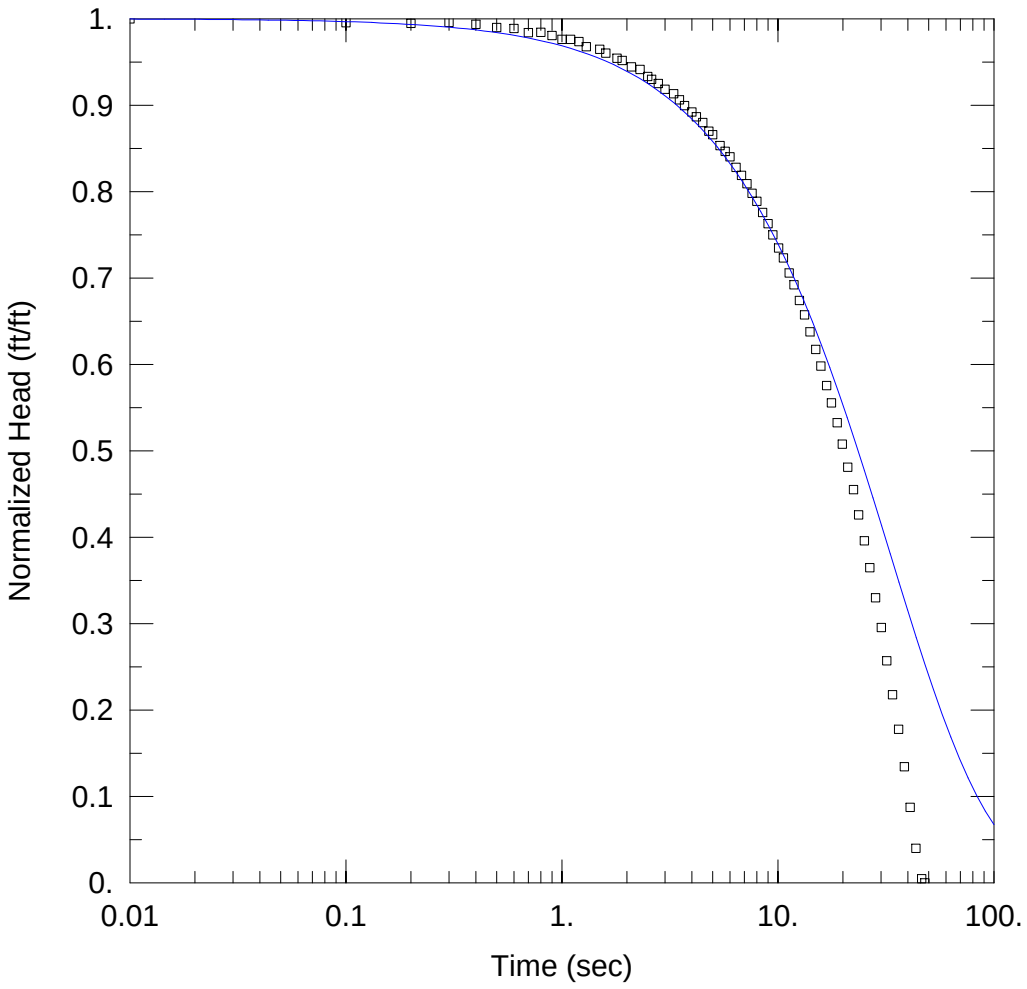
## WELL DATA (DO6)

Initial Displacement: 2.803 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DP8 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.001 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

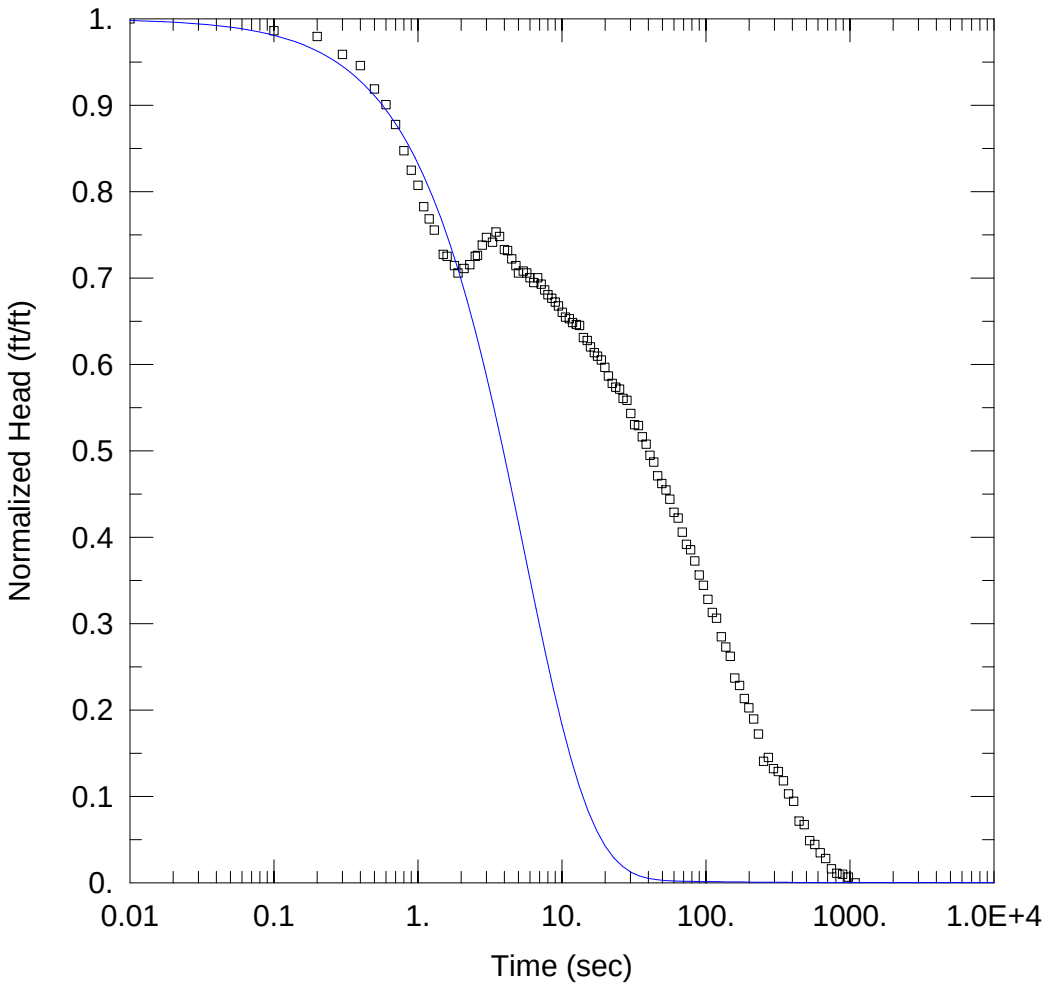
## WELL DATA (DP8)

Initial Displacement: 5.46 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DP8 Rising Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.006 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

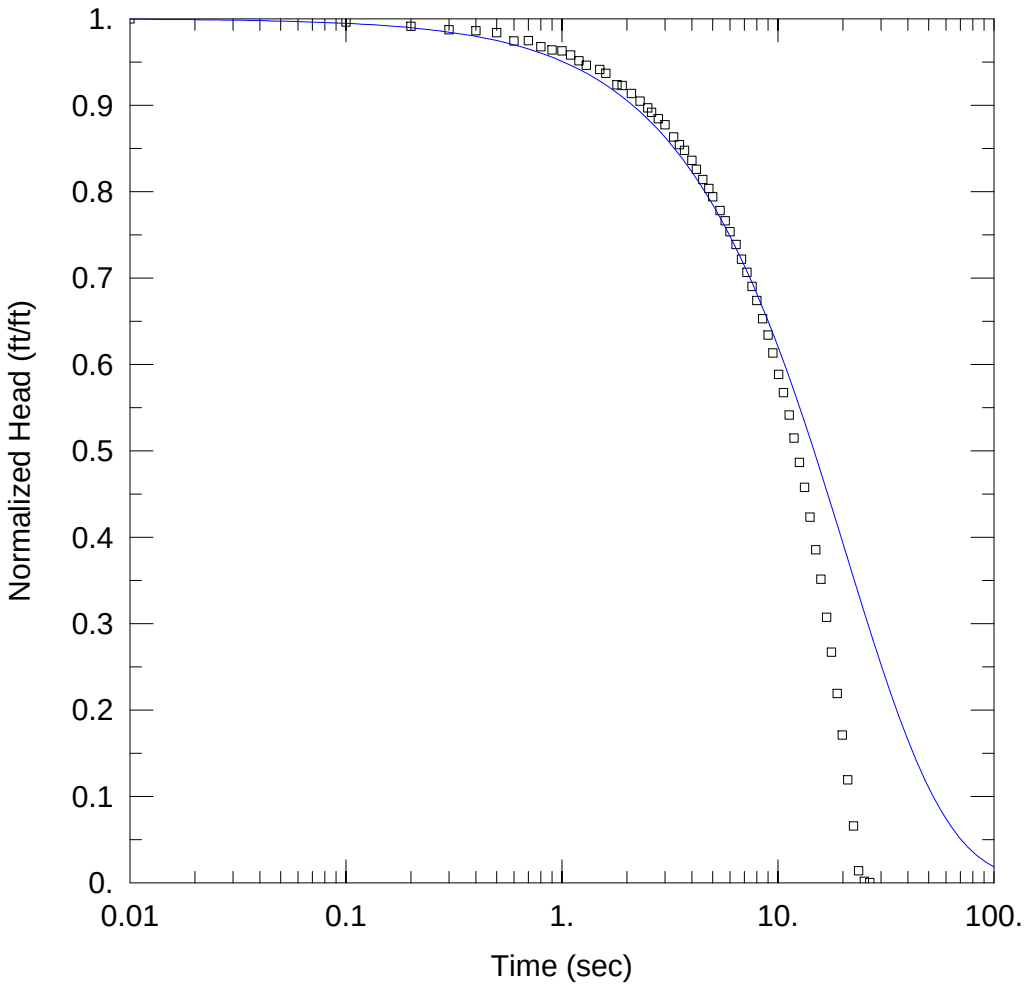
## WELL DATA (DP8)

Initial Displacement: 0.924 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DR7 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0016 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

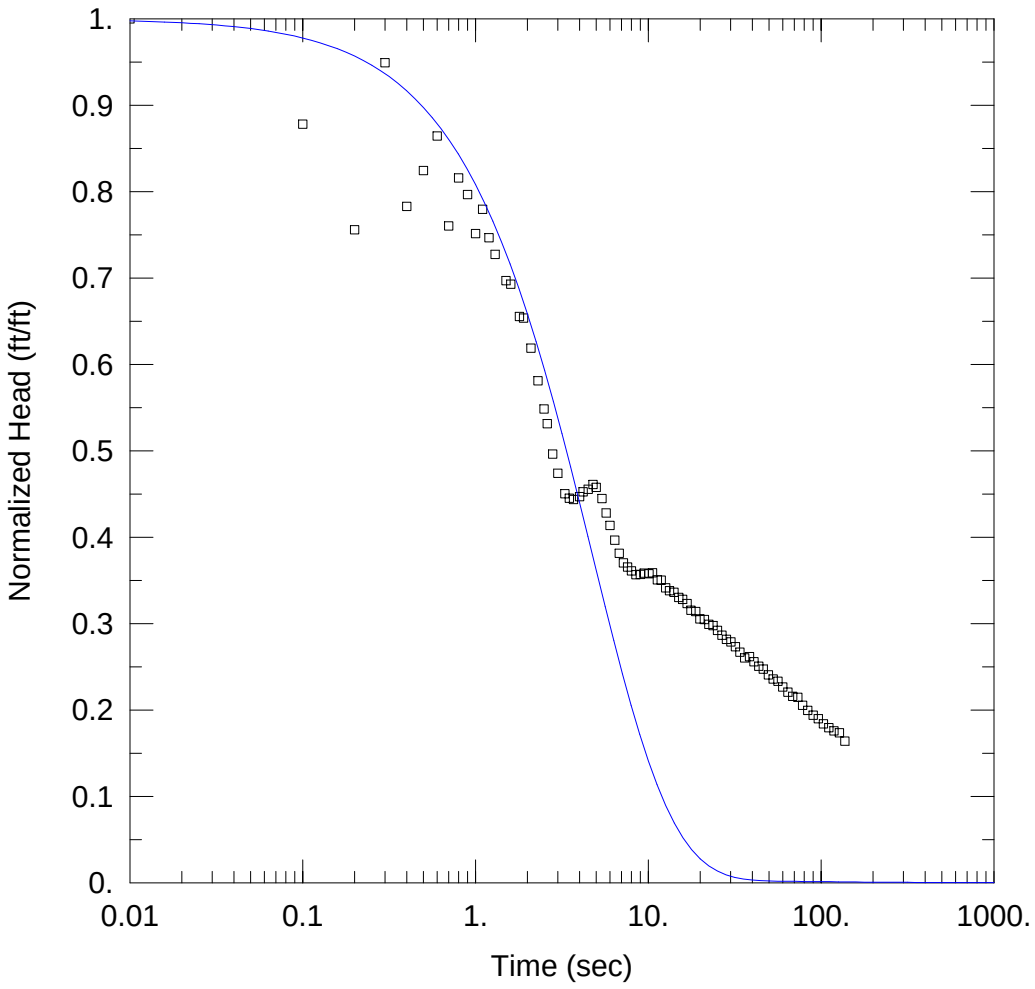
## WELL DATA (DO6)

Initial Displacement: 5.956 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DR7 Rising Head Test 2

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.007 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

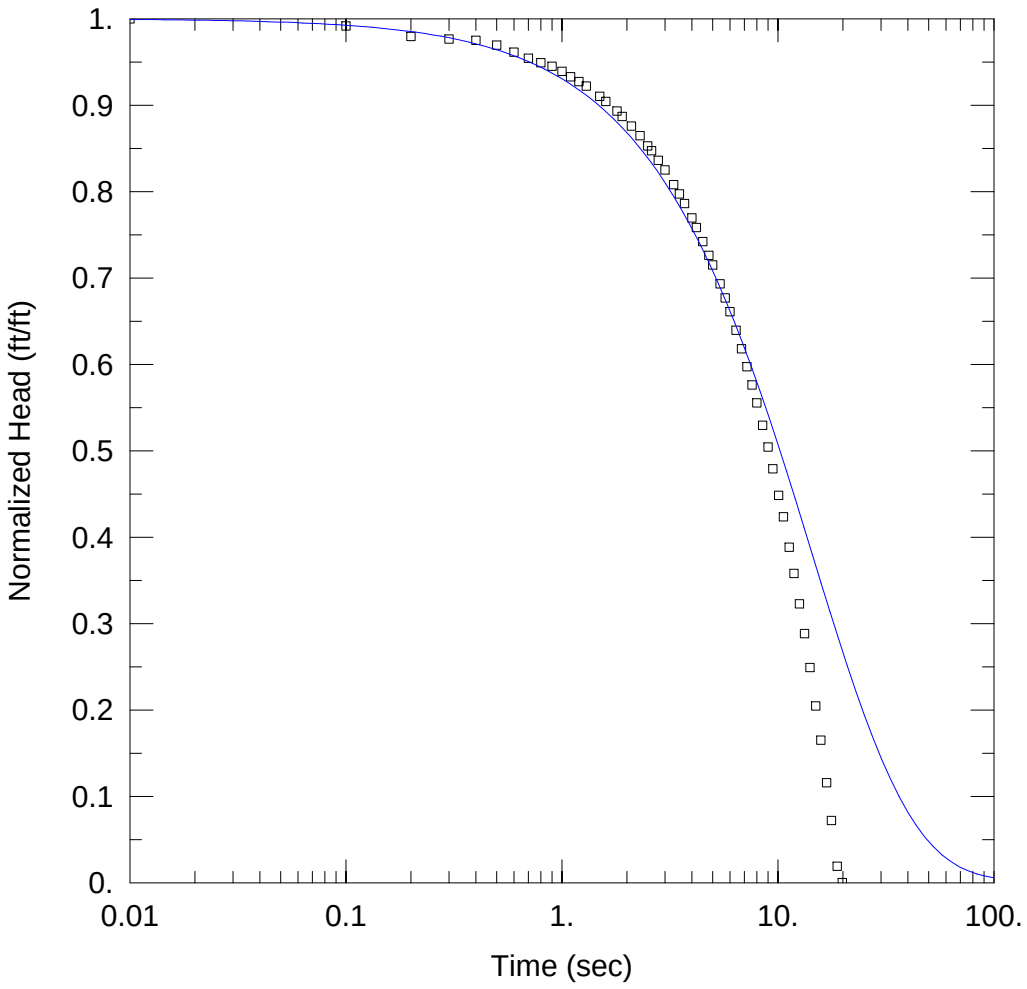
## WELL DATA (DR7)

Initial Displacement: 2.679 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DS2 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0023 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

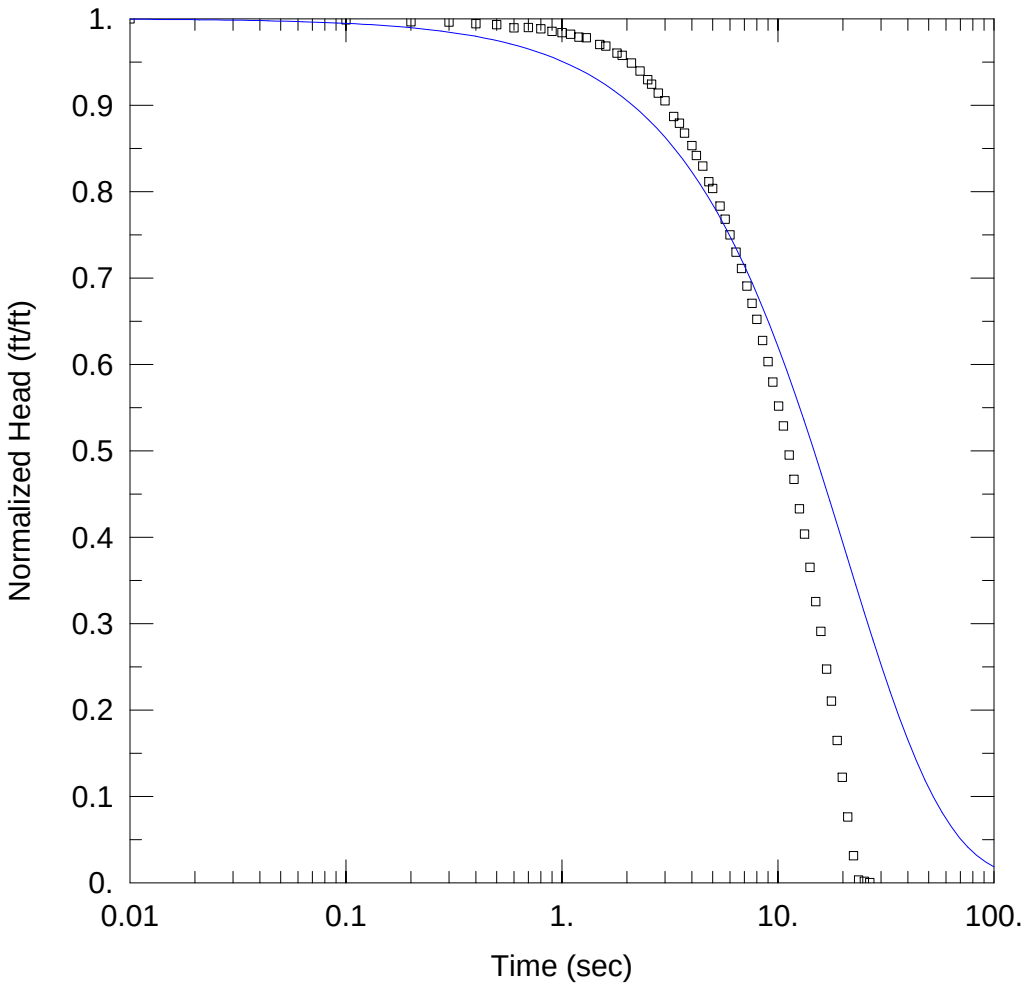
## WELL DATA (DS2)

Initial Displacement: 5.962 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# DY3 Falling Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0016 cm/sec  Ss = 1.0E-20 $ft^{-1}$
Kz/Kr = 1.

## AQUIFER DATA

Saturated Thickness: 10. ft

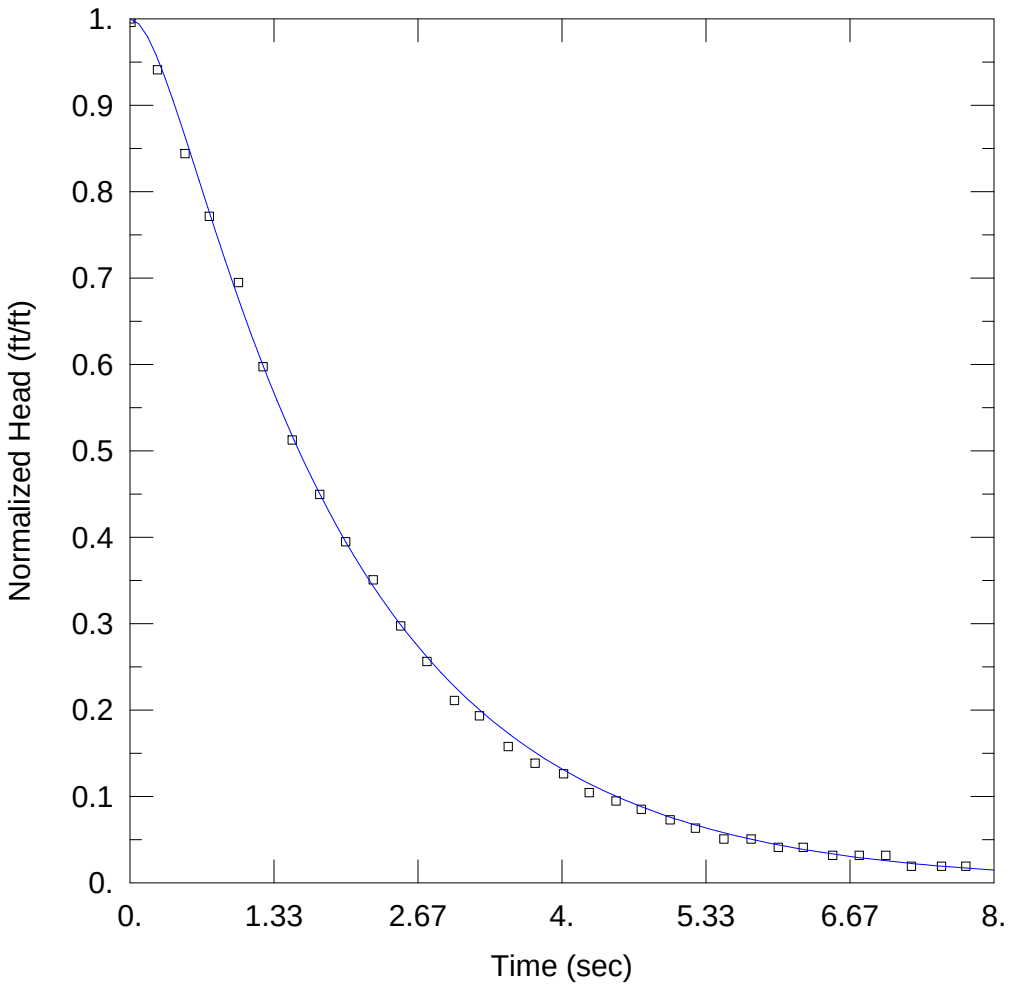
## WELL DATA (DY3)

Initial Displacement: 5.728 ft
Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft
Screen Length: 10. ft
Casing Radius: 0.0313 ft
Well Radius: 0.0417 ft

ARCADIS

# MW-01S Solid Slug Rising Head Test 2

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.02 cm/sec  Le = 16.37 ft

## AQUIFER DATA

Saturated Thickness: 4.89 Anisotropy Ratio (Kz/Kr): 1.

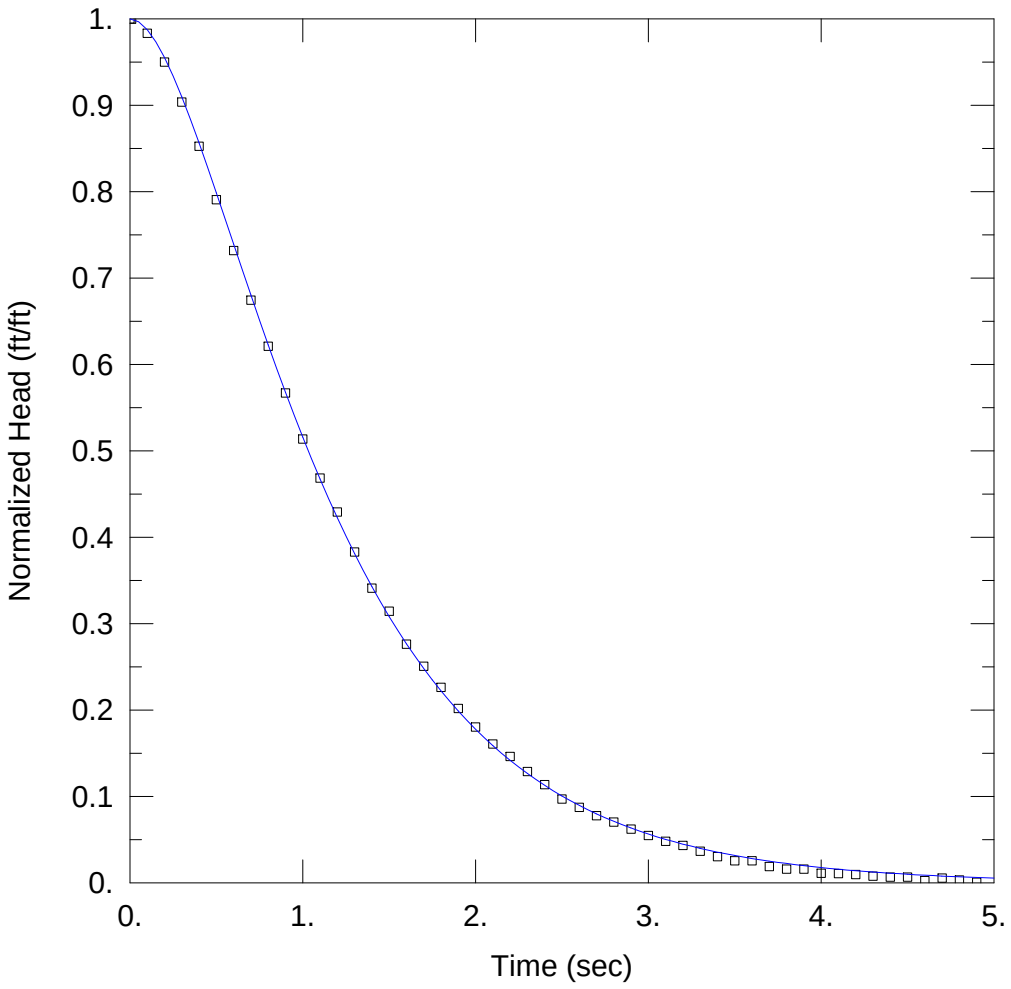
## WELL DATA (MW-01S)

Initial Displacement: 0.73 ft
Static Water Column Height: 4.89 ft
Total Well Penetration Depth: 4.89 ft
Screen Length: 4.89 ft
Casing Radius: 0.083 ft
Well Radius: 0.333 ft

ARCADIS

# MW-01D Pneumatic Rising Head Test 2

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.052 cm/sec  Le = 11.28 ft

## AQUIFER DATA

Saturated Thickness: 17.2 Anisotropy Ratio (Kz/Kr): 1.

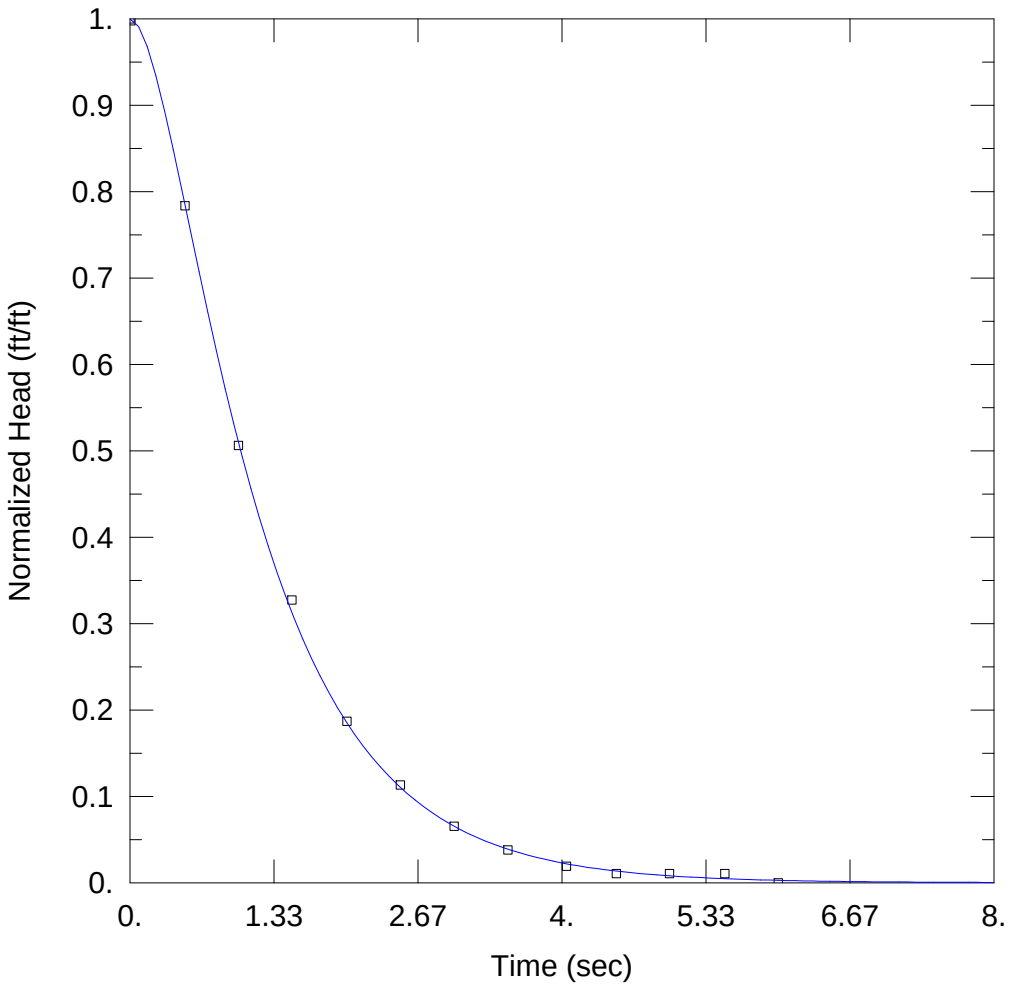
### WELL DATA (MW-01D)

Initial Displacement: 2.02 ft
Static Water Column Height: 17.28 ft
Total Well Penetration Depth: 17.3 ft
Screen Length: 4.1 ft
Casing Radius: 0.083 ft
Well Radius: 0.333 ft

ARCADIS

# MW-01D Solid Slug Rising Head Test 1

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.05 cm/sec  Le = 10.26 ft

## AQUIFER DATA

Saturated Thickness: 15.3 Anisotropy Ratio (Kz/Kr): 1.

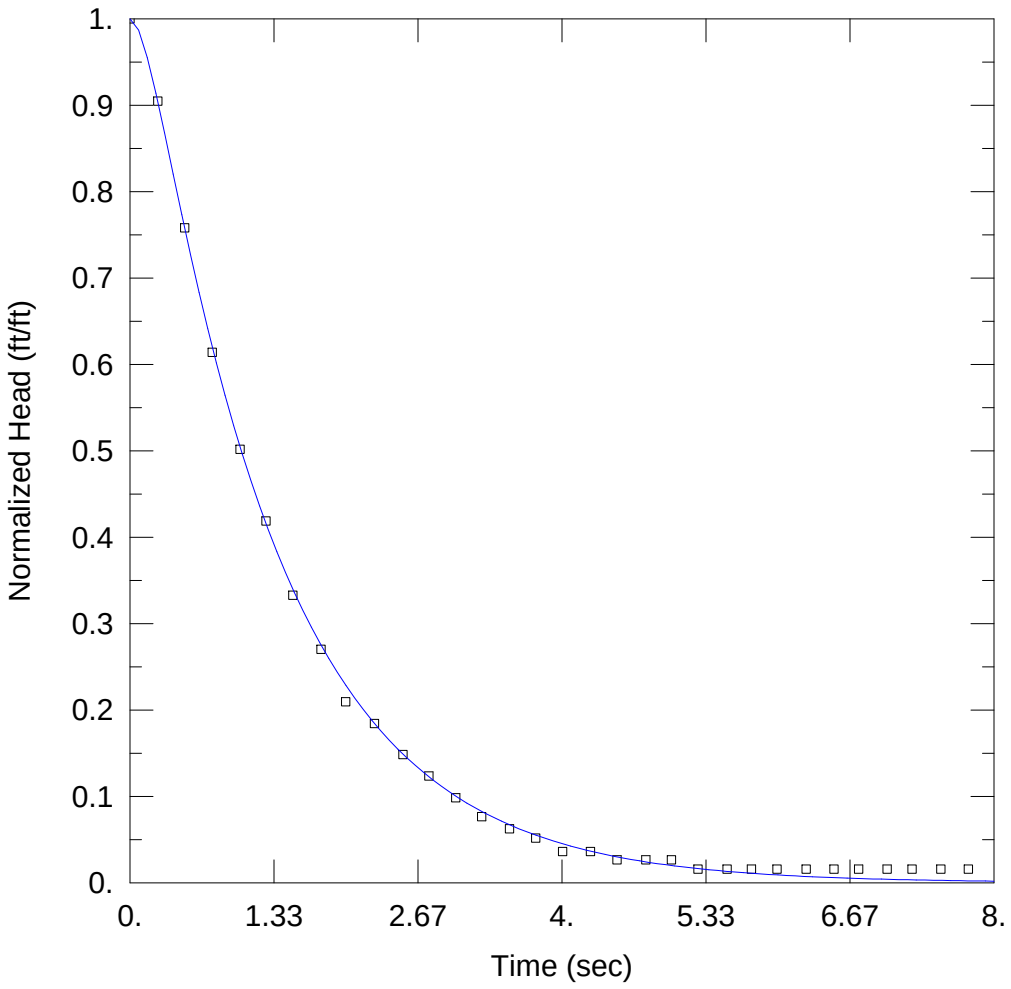
## WELL DATA (MW-01D)

Initial Displacement: 0.84 ft
Static Water Column Height: 15.36 ft
Total Well Penetration Depth: 15.4 ft
Screen Length: 4.1 ft
Casing Radius: 0.083 ft
Well Radius: 0.333 ft

ARCADIS

# MW-02S Solid Slug Rising Head Test 1

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.031 cm/sec  Le = 6.48 ft

## AQUIFER DATA

Saturated Thickness: 5.56 Anisotropy Ratio (Kz/Kr): 1.

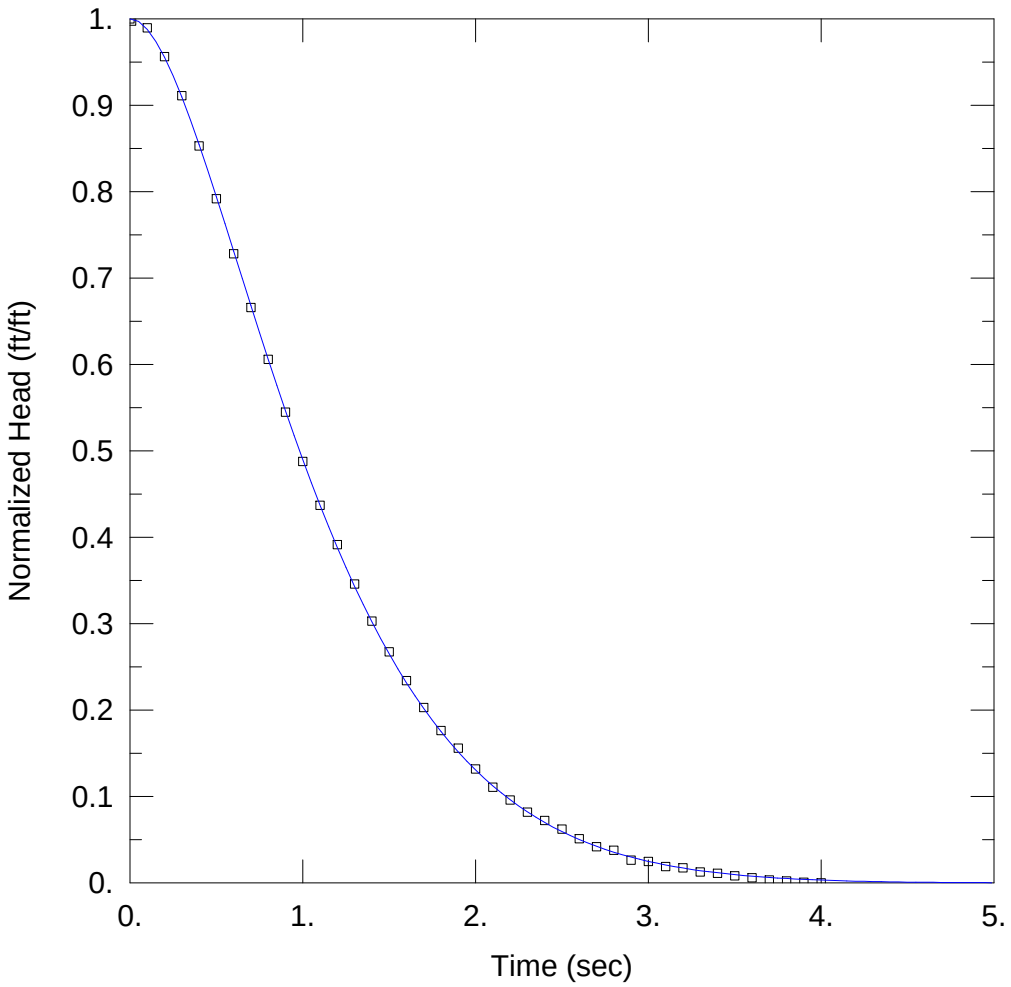
## WELL DATA (MW-02S)

Initial Displacement: 0.64 ft
Static Water Column Height: 5.56 ft
Total Well Penetration Depth: 5.5 ft
Screen Length: 4.9 ft
Casing Radius: 0.083 ft
Well Radius: 0.333 ft

ARCADIS

# MW-02D Pneumatic Rising Head Test 3

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.05 cm/sec  Le = 11.75 ft

## AQUIFER DATA

Saturated Thickness: 17.4 Anisotropy Ratio (Kz/Kr): 1.

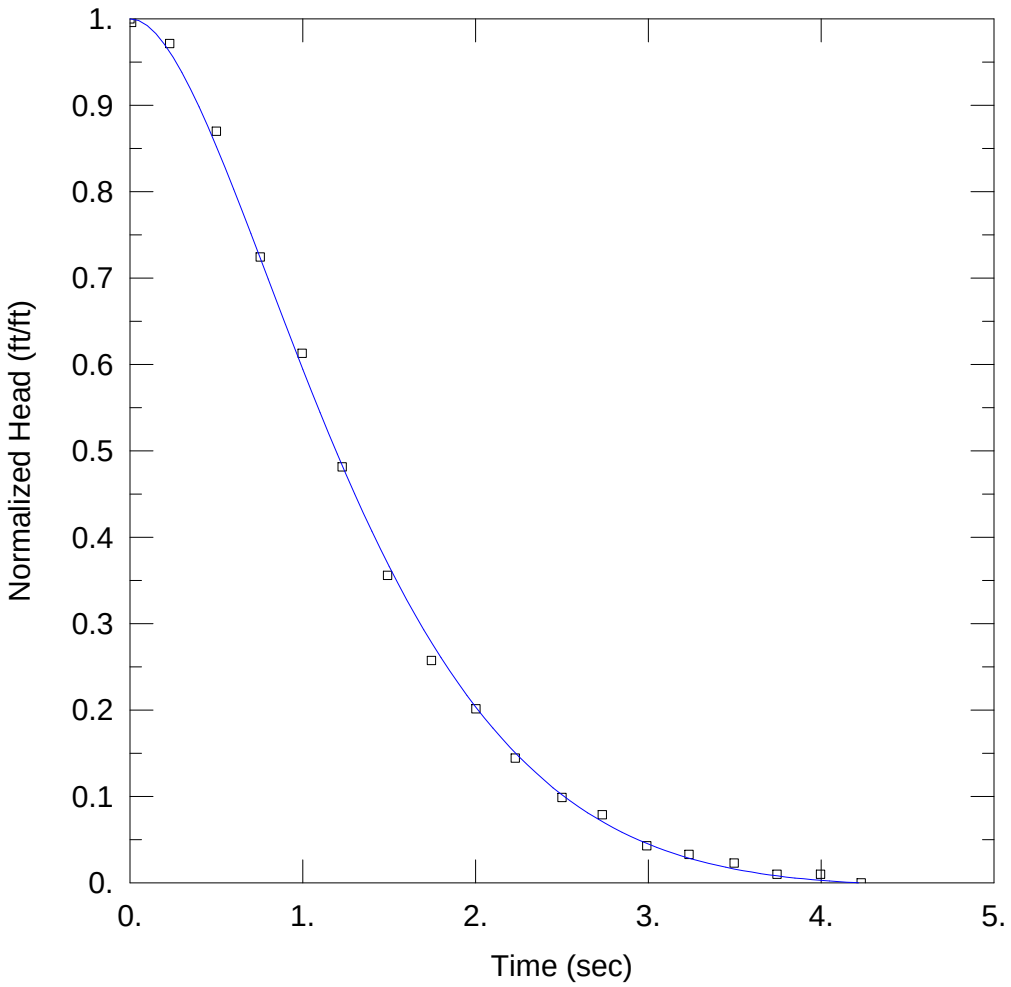
### WELL DATA (MW-02D)

Initial Displacement: 1.92 ft
Static Water Column Height: 17.43 ft
Total Well Penetration Depth: 17.5 ft
Screen Length: 4.9 ft
Casing Radius: 0.083 ft
Well Radius: 0.333 ft

ARCADIS

# MW-02D Solid Slug Rising Head Test 1

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.044 cm/sec  Le = 18.53 ft

## AQUIFER DATA

Saturated Thickness: 15.5 Anisotropy Ratio (Kz/Kr): 1.

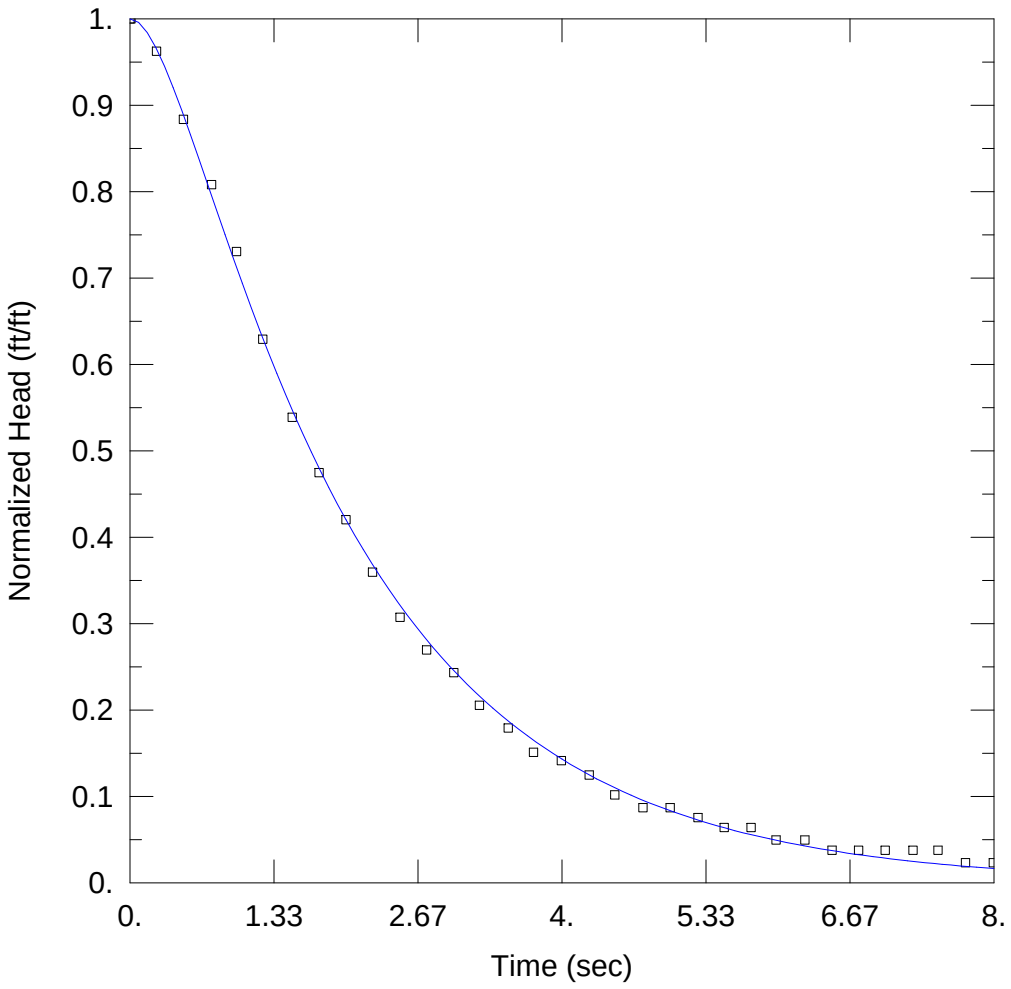
### WELL DATA (MW-02D)

Initial Displacement: 0.7 ft
Static Water Column Height: 15.52 ft
Total Well Penetration Depth: 15.5 ft
Screen Length: 4.9 ft
Casing Radius: 0.083 ft
Well Radius: 0.333 ft

ARCADIS

# MW-03 Solid Slug Rising Head Test 2

| Prepared By: | Prepared For: |
|---|---|
| Arcadis | National Guard |
| **Project:** | **Location:** |
| ESTCP GAAF | Grayling, MI |




## SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.019 cm/sec  Le = 21.3 ft

## AQUIFER DATA

Saturated Thickness: 4.9 fAnisotropy Ratio (Kz/Kr): 1.

## WELL DATA (MW-03)

Initial Displacement: 0.609 ft
Static Water Column Height: 4.9 ft
Total Well Penetration Depth: 4.9 ft
Screen Length: 4.9 ft
Casing Radius: 0.083 ft
Well Radius: 0.333 ft

ARCADIS

# APPENDIX E SOIL BORING LOGS/WELL CONSTRUCTION DIAGRAMS

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: SB-VRTB-02

Sheet: 1 of 3

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/15/2021
Date Completed: 09/15/2021

Logger: M. Olender
Editor: M. Humphrey
Weather Conditions: 64°F, Partly Cloudy

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | 60 | | NM | | (0.0-0.3') GRASS/ORGANICS. | | |
| 2 | | | | | NM | | (0.3-2.0') SAND, fine to coarse, subangular to subrounded; some very coarse sand to granules, subangular to subrounded; little small to large pebbles, subangular to subrounded; trace small cobbles, subrounded; poorly sorted; moist; dark yellowish brown (10YR 3/6). | | |
| 3 | | | | | NM | | (2.0-3.5') SAND, fine to coarse, subangular to subrounded; some very coarse sand to granules, subangular to subrounded; little small to large pebbles, subangular to subrounded; poorly sorted; moist; dark yellowish brown (10YR 4/6). | | |
| 4 | | | | | NM | | (3.5-8.5') SAND, fine to medium; some coarse sand, subangular to subrounded; little very coarse sand to granules, subangular to subrounded; trace small to large pebbles, subangular to subrounded; poorly sorted; moist; yellowish brown (10YR 5/6). | | |
| 5 | | | | | NM | | | | |
| 6 | | | 38 | | NM | | | (0.0-14.0' bgs) Backfilled with hydrated bentonite chips. | |
| 7 | | | | | NM | | | | |
| 8 | | | | | NM | | | | |
| 9 | | | | | NM | | (8.5-12.0') SAND, fine to coarse, subangular to subrounded; some very coarse sand to granules, subangular to subrounded; little small to medium pebbles, subangular to subrounded; poorly sorted; moist; pale brown (10YR 6/3). | | |
| 10 | | | | | NM | | | | |
| 11 | | | 42 | | NM | | Note: Silt, fine to medium sand lens observered from 11.0-11.1' bgs. | | |
| 12 | | | | | NM | | | | |
| 13 | | | | | NM | | (12.0-16.5') SAND, fine to medium; little coarse sand to granules, subangular to subrounded; trace small pebbles, subrounded; poorly sorted; moist to wet; pale brown (10YR 6/3). | | |
| 14 | | | | | NM | | | | |
| 15 | | | | | NM | | | CMT Port #1 15' bgs | |
| 16 | | | | | NM | | Note: Wet at 15.3' bgs. | CMT Port #2 17' bgs | |
| 17 | | | 44 | SB-VRTB-02_15-16.5 @ 1530 | NM | | (16.5-18.0') SAND, medium to coarse, subangular to subrounded; some fine sand; some very coarse sand to granules, subangular to subrounded; little small pebbles, poorly sorted; wet; pale brown (10YR 6/3). | (14.0-50.0' bgs) Natural Collapse. | |
| 18 | | | | | NM | | | | |
| 19 | | | | | NM | | (18.0-22.3') SAND, medium to very coarse, subangular to subrounded; some fine sand; little granules, subrounded; poorly sorted; wet; pale brown (10YR 6/3). | | |
| 20 | | | | | NM | | | CMT Port #3 19.5' bgs | |

Drilling Co.: Cascade
Driller: R. Reagan
Drilling Method: Hand Auger/Direct Push
Drilling Fluid: None
Remarks: bgs = below ground surface; NA = not applicable; btoc = below top of casing; ft = feet; NM= not measured.

Sampling Method: 5.0' Macrocore
Sampling Interval: Continuous
Water Level Start (ft. bgs.): 15.3
Water Level Finish (ft. btoc.): NA
Converted to Well: ☐ Yes ☒ No
Surface Elev.:
North Coor:
East Coor:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

Boring No.: SB-VRTB-02

# Soil Boring Log

Sheet: 2 of 3

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/15/2021
Date Completed: 09/15/2021

Logger: M. Olender
Editor: M. Humphrey
Weather Conditions: 64°F, Partly Cloudy

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 21 | | | | | NM | | (18.0-22.3') SAND, medium to very coarse, subangular to subrounded; some fine sand; little granules, subrounded; poorly sorted; wet; pale brown (10YR 6/3). | | |
| 22 | | | | | NM | | | | |
| 23 | | | 36 | | NM | | (22.3-22.5') SAND, medium to very coarse, subangular to subrounded; some small to large pebbles, subangular to subrounded; little granules, subangular to subrounded; poorly sorted; wet; brown (10YR 5/3). | CMT Port #4 23' bgs | |
| 24 | | | | SB-VRTB-02_22.5-25 @ 1540 | NM | | (22.5-27.0') SAND, fine to coarse, subangular to subrounded; little very coarse sand to granules, subangular to subrounded; trace small pebbles, subrounded; poorly sorted; wet; brown (10YR 5/3). | | |
| 25 | | | | | NM | | | | |
| 26 | | | | | NM | | | CMT Port #5 26.5' bgs | |
| 27 | | | | | NM | | | | |
| 28 | | | 42 | | NM | | (27.0-35.0') SAND, medium to very coarse, subangular to subrounded; some fine sand; little granules, subrounded; poorly sorted; wet; pale brown (10YR 6/3). | | |
| 29 | | | | | NM | | | | |
| 30 | | | | | NM | | | CMT Port #6 30.5' bgs | |
| 31 | | | | | NM | | | (14.0-50.0' bgs) Natural Collapse. | |
| 32 | | | | | NM | | | | |
| 33 | | | 53 | SB-VRTB-02_32-34 @ 1550 | NM | | | | |
| 34 | | | | | NM | | | | |
| 35 | | | | | NM | | | | |
| 36 | | | | | NM | | (35.0-38.5') SAND, fine to coarse, subangular to subrounded; some very coarse sand to granules; little small to medium pebbles, subangular to subrounded; poorly sorted; wet; brown (10YR 5/3). | | |
| 37 | | | | SB-VRTB-02_35-38.5 @ 1610 SB-VRTB-DUP-03 | NM | | | CMT Port #7 36.5' bgs | |
| 38 | | | 55 | | NM | | | | |
| 39 | | | | | NM | | (38.5-39.0') SAND, fine to coarse, subangular to subrounded; some very coarse sand to large pebbles, subangular to subrounded; poorly sorted; wet; brown (10YR 5/3). | | |
| 40 | | | | SB-VRTB-02_39-40 @ 1605 | NM | | (39.0-40.0') SAND, fine to coarse, subangular to subrounded; some very coarse sand to granules; little small to medium pebbles, subangular to subrounded; poorly sorted; wet; brown (10YR 5/3). | | |
| 41 | | | | | | | | | |

Remarks: Multi-level CMT well with 7 ports installed at SB-VRTB-03; CMT well ID is CMT-VRTB-01, port IDs are CMT-VRTB-01_1 through CMT-VRTB-01_7. All ports are accessible from a central location in a flush mount; ports are labeled (port 7 is in the center). Use 1/4" tubing for groundwater sampling; a small diameter WLM may fit down select port access tubing.

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: SB-VRTB-02

Sheet: 3 of 3

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/15/2021
Date Completed: 09/15/2021

Logger: M. Olender
Editor: M. Humphrey
Weather Conditions: 64°F, Partly Cloudy

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 42 | | | | | | | (40.0-50.0') Blind drilled to install a fiber optic cable from 50 ft bgs to the surface for ADT-S testing in collaboration with the University of Guelph G360 Group. | (14.0-50.0' bgs) Natural Collapse. | |
| 43 | | | | | | | | | |
| 44 | | | | | | | | | |
| 45 | | | | | | | | | |
| 46 | | | | | | | | | |
| 47 | | | | | | | | | |
| 48 | | | | | | | | | |
| 49 | | | | | | | | | |
| 50 | | | | | | | | | |
| 51 | | | | | | | End or boring at 50.0' bgs. | | |
| 52 | | | | | | | General Notes:<br>VAP sampling completed on 9/14/2021 on intervals: (15-19), (20-24), (25-29), (30-34), and (36-40) ft bgs. All VAP Samples collected on 9/13/2021 from an adjacent borehole. | | |
| 53 | | | | | | | Pneumatic slug testing completed on 9/14/2021 on intervals: (36-40), (30-34), (25-29), and (20-24) ft bgs. No pneumatic slug testing completed on (15-19) ft bgs interval. | | |
| 54 | | | | | | | VAP sampling and pneumatic slug testing both completed "bottom up". | | |
| 55 | | | | | | | Grain size samples submitted for soil sample intervals: (15-16.5), (22.5-25), (32-34), (35-38.5) and (39-40) ft bgs. | | |
| 56 | | | | | | | | | |
| 57 | | | | | | | | | |
| 58 | | | | | | | | | |
| 59 | | | | | | | | | |
| 60 | | | | | | | | | |
| 61 | | | | | | | | | |
| 62 | | | | | | | | | |

Remarks:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

Boring No.: SB-VRTB-03

# Soil Boring Log

Sheet: 1 of 3

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/14/2021
Date Completed: 09/15/2021

Logger: K. Hasbrouck
Editor: M. Humphrey
Weather Conditions: 75°F, Partly Cloudy

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | NM | | (0.0-1.0') SAND, very fine to medium; little silt; trace coarse sand to medium pebbles, angular to subrounded; trace clay; poorly sorted; moist; dark brown (10YR 3/3). | (0.0-1.0' bgs) Flushmount. | |
| 2 | | | | | NM | | (1.0-2.0') SAND, fine to coarse, subangular to subrounded; trace very coarse sand to large pebbles, subangular to rounded; trace silt; poorly sorted; dry to moist; dark yellowish brown (10YR 4/4). | (1.0-2.0' bgs) Filter Pack Sand. | |
| 3 | | | 60 | | NM | | (2.0-6.0') SAND, fine to coarse, subangular to subrounded; little very coarse sand to very large pebbles, subangular to rounded; trace silt; poorly sorted; dry to moist; yellowish brown (10YR 5/4). | | |
| 4 | | | | | NM | | | | |
| 5 | | | | | NM | | | | |
| 6 | | | | | NM | | | (2.0-9.8' bgs) Backfilled With hydrated Bentonite Chips. | |
| 7 | | | | | NM | | (6.0-8.0') SAND, fine to coarse, subangular to subrounded; some very coarse sand to small cobbles, subangular to rounded; trace silt; poorly sorted; dry to moist; brown (10YR 4/3). | | |
| 8 | | | 24 | | NM | | | | |
| 9 | | | | | NM | | (8.0-10.0') SAND, fine to coarse, subangular to subrounded; little very coarse sand to large pebbles, subangular to rounded; trace silt; poorly sorted; dry to moist; brown (10YR 5/3). | | |
| 10 | | | | | NM | | | | |
| 11 | | | | SB-VRTB-03_10.5-11 @ 1215 9/14/2021 | NM | | (10.0-10.3') SAND, very fine to medium; little coarse sand to granules, subangular to subrounded; trace small pebbles, subangular to subrounded; trace silt; poorly sorted; dry to moist; brown (10YR 4/3). | | |
| 12 | | | | SB-VRTB-03_11.5-12 @ 1220 9/14/2021 | NM | | (10.3-10.5') SAND, very fine to coarse, angular to subrounded; some very coarse sand to granules, angular to subrounded; little small to medium pebbles, angular to subrounded; trace silt; poorly sorted; dry to moist; pale brown (10YR 6/3). | (9.8-14.0' bgs) Filter Pack Sand. | |
| 13 | | | 58 | SB-VRTB-03_12.5-13 @ 1225 9/14/2021; SB-VRTB-DUP-01 | NM | | (10.5-11.3') SAND, very fine to medium; little coarse sand to granules, subangular to subrounded; trace small to medium pebbles, angular to subrounded; poorly sorted; dry to moist; brown (10YR 4/2). | | |
| 14 | | | | SB-VRTB-03_13-13.5 @ 1235 9/14/2021 | NM | | (11.3-11.5') SAND, very fine to very coarse, subangular to subrounded; little granules, angular to subrounded; trace small to medium pebbles, subangular to subrounded; poorly sorted; dry; pale brown (10YR 6/3). | | |
| 15 | | | | SB-VRTB-03_13.75-14 @ 1240 9/14/2021 | NM | | (11.5-11.6') SAND, very fine to medium; little coarse sand to granules, subangular to subrounded; trace small to medium pebbles, angular to subrounded; poorly sorted; dry to moist; brown (10YR 4/2). | | |
| 16 | | | | SB-VRTB-03_14-14.25 @ 1243 9/14/2021 | NM | | (11.6-11.7') SAND, very fine to very coarse, subangular to subrounded; little granules, angular to subrounded; trace small to medium pebbles, subangular to subrounded; poorly sorted; dry; pale brown (10YR 6/3). | (14.0-40.0' bgs) Natural Collapse. | |
| 17 | | | | SB-VRTB-03_14.25-14.5 | | | | | |
| 18 | | | 59 | @ 1245 09/14/2021 SB-VRTB-03_14.75-15 | NM | | (11.7-11.8') SAND, very fine to medium; little coarse sand to granules, subangular to subrounded; trace small to medium pebbles, angular to subrounded; poorly sorted; dry to moist; brown (10YR 4/2). | | |
| 19 | | | | @ 1250 09/14/2021 SB-VRTB-03_15.25-15.5 | NM | | | | |
| 20 | | | | @ 1415 09/14/2021 | NM | | (11.8-12.2') SAND, very fine to very coarse, subangular to subrounded; little granules, angular to subrounded; trace | | |

Drilling Co.: Cascade
Driller: C. Bond
Drilling Method: Sonic Drilling
Drilling Fluid: None
Remarks: bgs = below ground surface; NA = not applicable; btoc = below top of casing; ft = feet; NM= not measured. Lexan liners used with sonic drilling. Golden Spike boring. CMT multiple port well installed, surface completed as flush mount. Used catchers from 25.0-40.0' bgs.

Sampling Method: 5.0' Acetate Lexan Core
Sampling Interval: Continuous
Water Level Start (ft. bgs.): 15.5
Water Level Finish (ft. btoc.): NA
Converted to Well: ☒ Yes ☐ No
Surface Elev.:
North Coor:
East Coor:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

Boring No.: SB-VRTB-03

# Soil Boring Log

Sheet: 2 of 3

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/14/2021
Date Completed: 09/15/2021

Logger: K. Hasbrouck
Editor: M. Humphrey
Weather Conditions: 75°F, Partly Cloudy

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 21 | | | | SB-VRTB-03_15.75-16 @ 1420 09/14/2021 | NM | | small to medium pebbles, subangular to subrounded; poorly sorted; dry; pale brown (10YR 6/3). | | |
| 22 | | | | SB-VRTB-03_16.25-16.5 @ 1425 09/14/2021 | NM | | (12.2-13.8') SAND, very fine to fine; little medium sand; trace granules to medium pebbles, angular to rounded; well sorted; dry; pale brown (10YR 6/3). | | |
| 23 | | | 41 | SB-VRTB-03_16.5-17 @ 1430 09/14/2021 | NM | | (13.8-15.5') SAND, fine to medium; little coarse sand to granules, angular to subrounded; trace small to medium pebbles, subangular to rounded; poorly sorted; dry; pale brown (10YR 6/3). Note: Wet at 15.0' bgs; color change to dark yellowish brown (10YR 4/4) at 15.0' bgs. | | |
| 24 | | | | SB-VRTB-03_17-17.5 @ 1440 09/14/2021 | NM | | (15.5-16.0') SAND, very fine to coarse, subangular to subrounded; little granules, angular to subrounded; little small to medium pebbles, subangular to subrounded; trace silt; poorly sorted; wet; yellowish brown (10YR 5/4). | | |
| 25 | | | | SB-VRTB-03_18-18.5 @ 1445 09/14/2021 | NM | | | | |
| 26 | | | | SB-VRTB-03_19-19.5 @ 1448 09/14/2021 | NM | | (16.0-19.3') SAND, fine to coarse, subangular to subrounded; some very coarse sand to granules, angular to subrounded; little small to large pebbles, subangular to rounded; trace silt; poorly sorted; wet; yellowish brown (10YR 5/4). | | |
| 27 | | | | SB-VRTB-03_20.5-21 @ 1550 09/14/2021 | NM | | (19.3-20.1') SAND, very fine to medium; little coarse sand to granules, subangular to subrounded; little silt; trace small to medium pebbles, subangular to subrounded; poorly sorted; wet; brown (10YR 4/3). | | |
| 28 | | | 31 | SB-VRTB-03_22.5-23 @ 1555 09/14/2021 | NM | | (20.1-24.5') SAND, very fine to coarse, subangular to subrounded; some very coarse sand to small pebbles, angular to subrounded; little medium to large pebbles, subangular to rounded; trace silt; poorly sorted; wet; brown (10YR 5/3). | | |
| 29 | | | | SB-VRTB-03_24-24.5 @ 1600 09/14/2021 | NM | | | | |
| 30 | | | | SB-VRTB-03_26-26.5 @ 0940 09/15/2021 | NM | | (24.5-25.3') SAND, very fine to medium; trace coarse sand to granules, subrounded to angular; trace silt; trace small to medium pebbles, subangular to rounded; well sorted; wet; brown (10YR 5/3). | (14.0-40.0' bgs) Natural Collapse. | |
| 31 | | | | SB-VRTB-03_27-27.5 @ 0950 9/15/2021 | NM | | (25.3-25.7') SAND, fine to coarse; angular to subrounded; some very coarse sand to small pebbles, angular to subrounded; trace medium to large pebbles, subangular to rounded; trace silt; poorly sorted; wet; brown (10YR 5/3). | | |
| 32 | | | | SB-VRTB-03_30-30.5 @ 1045 9/15/2021 | NM | | | | |
| 33 | | | 46 | SB-VRTB-03_32-32.5 @ 1048 9/15/2021 MS/MSD collected | NM | | (25.7-26.3') SAND, fine to coarse, subangular to subrounded; little very coarse sand to granules, angular to subrounded; trace small pebbles, subangular to subrounded; trace silt; poorly sorted; wet; brown (10YR 5/3). | | |
| 34 | | | | SB-VRTB-03_34-34.5 @ 1052 9/15/2021; SB-VRTB-DUP-02 | NM | | (26.3-26.6') SAND, fine to very coarse, subrounded to angular; and GRANULES to PEBBLES, small, subrounded to angular; trace silt; poorly sorted; wet; brown (10YR 5/3). | | |
| 35 | | | | SB-VRTB-03_35-35.5 @ 1146 9/15/2021 | NM | | (26.6-27.4) SAND, fine to coarse, subangular to subrounded; some very coarse sand to small pebbles; trace medium to large pebbles, subangular to rounded; trace angular to subrounded; poorly sorted; wet; brown (10YR 5/3). | | |
| 36 | | | | SB-VRTB-03_36-36.5 @ 1142 9/15/2021 | NM | | (27.4-30.0') NO RECOVERY. | | |
| 37 | | | | | | | (30.0-31.2') SAND, fine to very coarse, angular to subrounded; and GRANULES to PEBBLES, small, angular to subrounded; trace medium to large pebbles, subangular to rounded; trace silt; poorly sorted; wet; brown (10YR 5/3). | | |
| 38 | | | 33 | | NM | | | | |
| 39 | | | | | NM | | (31.2-33.5') SAND, very fine to medium; some coarse sand to granules, subrounded to angular; trace small pebbles; trace silt; well sorted; wet; brown (10YR 5/3). | | |
| 40 | | | | | NM | | (33.5-33.8') SAND, fine to very coarse, subrounded to angular; and GRANULES to PEBBLES, small, subangular to subrounded; little medium pebbles, subangular to subrounded; trace silt; poorly sorted; wet; brown (10YR 5/3). | | |
| 41 | | | | | | | (33.8-37.0') SAND, very fine to coarse, subangular to subrounded; little very coarse sand to granules, | | |

Remarks:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

Boring No.: SB-VRTB-03

# Soil Boring Log

Sheet: 3 of 3

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/14/2021
Date Completed: 09/15/2021

Logger: K. Hasbrouck
Editor: M. Humphrey
Weather Conditions: 75°F, Partly Cloudy

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 42 | | | | | | | subrounded to angular; trace small pebbles, subangular to subrounded; trace silt; poorly sorted; wet; brown (10YR 5/3). | | |
| 43 | | | | | | | (37.0-40.0') NO RECOVERY. | | |
| 44 | | | | | | | End of boring at 40.0' bgs. | | |
| 45 | | | | | | | General Notes:<br>CMT parts at 15', 17', 19.5', 23', 26.5', 30.5', and 36.5' bgs. | | |
| 46 | | | | | | | VAP sampling completed on 9/16/2021 on intervals: (15-19), (19-23), (23-27), (27.5-31.5), (32-36), and (36-40) ft bgs. All VAP Samples collected on 9/16/2021 from an adjacent borehole. | | |
| 47 | | | | | | | Pneumatic slug testing completed on 9/16/2021 on intervals: (36-40), (32-36), (27.5-31.5), (23-27), and (19-23) ft bgs.<br>No pneumatic slug testing completed on (15-19) ft bgs interval. | | |
| 48 | | | | | | | VAP sampling and pneumatic slug testing both completed "bottom up". | | |
| 49 | | | | | | | Grain size samples submitted for soil sample intervals: (13-13.5), (16.5-17), (19-19.5), (26-26.5) and (30-30.5) ft bgs. | | |
| 50 | | | | | | | | | |
| 51 | | | | | | | | | |
| 52 | | | | | | | | | |
| 53 | | | | | | | | | |
| 54 | | | | | | | | | |
| 55 | | | | | | | | | |
| 56 | | | | | | | | | |
| 57 | | | | | | | | | |
| 58 | | | | | | | | | |
| 59 | | | | | | | | | |
| 60 | | | | | | | | | |
| 61 | | | | | | | | | |
| 62 | | | | | | | | | |

Remarks:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: SB-VRTB-04

Sheet: 1 of 3

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/16/2021
Date Completed: 09/16/2021

Logger: A. Westhuis
Editor: M. Humphrey
Weather Conditions: 75°F, Partly Cloudy

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | 60 | | NM | | (0.0-0.3') GRASS/TOPSOIL. | | |
| 2 | | | | | NM | | (0.3-2.5') SAND, fine to medium, subrounded; trace very fine sand; trace granules to medium pebbles, subrounded; trace silt; well sorted; dry; dark yellowish brown (10YR 4/6). | | |
| 3 | | | | | NM | | (2.5-5.0') SAND, medium, subrounded; little fine sand, subrounded; trace very fine sand; trace silt; trace granules, subrounded; well sorted; dry; light yellowish brown (10YR 6/4). | | |
| 4 | | | | | NM | | | | |
| 5 | | | | | NM | | | | |
| 6 | | | 44 | | NM | | (5.0-9.0') SAND, fine to medium, subrounded; trace very fine sand; trace granules to small pebbles, subrounded; little to trace silt; well sorted; dry; light yellowish brown (10YR 6/4). | (0.0-14.0' bgs) Backfilled with hydrated bentonite chips. | |
| 7 | | | | | NM | | | | |
| 8 | | | | | NM | | | | |
| 9 | | | | | NM | | | | |
| 10 | | | | | NM | | (9.0-11.0') SAND, fine, subrounded; little to some medium sand, subrounded; trace silt; well sorted; dry; light yellowish brown (10YR 6/4). | | |
| 11 | | | 33 | | NM | | | | |
| 12 | | | | | NM | | (11.0-12.0') SAND, medium, subrounded; little fine sand, subrounded; trace to little granules, subrounded; trace silt; poorly sorted; dry; light yellowish brown (10YR 6/4). | | |
| 13 | | | | | NM | | (12.0-16.5') SAND, fine, subrounded; little medium sand, subrounded; trace to little very fine sand; trace silt; well sorted; moist to wet; pale brown (10YR 6/3). | | |
| 14 | | | | SB-VRTB-04_12-16.5 @ 1324 | NM | | | | |
| 15 | | | | | NM | | Note: Wet at 15.0' bgs. | | |
| 16 | | | 35 | | NM | | | | |
| 17 | | | | | NM | | (16.5-17.5') SAND, medium, subrounded; some fine sand, subrounded; trace very fine sand, subrounded; little to trace granules, subrounded; trace silt; poorly sorted; wet; pale brown (10YR 6/3). Note: Large pebble at 17.5' bgs. | (14.0-50.0' bgs) Natural Collapse. | |
| 18 | | | | | NM | | (17.5-20.0') SAND, fine to medium, subrounded; trace very fine sand; trace granules, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3). | | |
| 19 | | | | SB-VRTB-04_17.5-20 @ 1328 | NM | | | | |
| 20 | | | | | NM | | | | |

Drilling Co.: Cascade
Driller: J. Ashe
Drilling Method: Hand Auger/Direct Push
Drilling Fluid: None
Remarks: bgs = below ground surface; NA = not applicable; btoc = below top of casing; ft = feet; NM= not measured.

Sampling Method: 5.0' Macrocore
Sampling Interval: Continuous
Water Level Start (ft. bgs.): 15
Water Level Finish (ft. btoc.): NA
Converted to Well: ☐ Yes ☒ No
Surface Elev.:
North Coor:
East Coor:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: SB-VRTB-04



Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/16/2021
Date Completed: 09/16/2021

Logger: A. Westhuis
Editor: M. Humphrey
Weather Conditions: 75°F, Partly Cloudy

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 21 | | | 40 | SB-VRTB-04_22.5-24.5 @ 1335 | NM | | (20.0-24.5') SAND, medium, subrounded; some to little fine sand, subrounded; little granules to small pebbles, subrounded to subangular; trace very fine sand; trace medium sand to large pebbles, rounded; trace silt; poorly sorted; wet; pale brown (10YR 6/3). | (14.0-50.0' bgs) Natural Collapse. | |
| 22 | | | | | NM | | | | |
| 23 | | | | | NM | | | | |
| 24 | | | | | NM | | | | |
| 25 | | | | | NM | | (24.5-26.5') SAND, medium to coarse, subrounded; little to some very fine sand, subrounded; trace coarse sand, subrounded; trace granules, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3). | | |
| 26 | | | | | NM | | | | |
| 27 | | | 42 | SB-VRTB-04_26.5-27.5 @ 1340 | NM | | (26.5-27.5') SAND, medium to coarse, subrounded; little fine sand, subrounded; trace very fine sand; little granules to small pebbles, subrounded to rounded; trace medium to large pebbles, rounded; trace silt; poorly sorted; wet; pale brown (10YR 6/3). | | |
| 28 | | | | | NM | | (27.5-34.0') SAND, very fine to fine, subrounded; little medium sand, subrounded; trace granules, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3). | | |
| 29 | | | | | NM | | | | |
| 30 | | | | | NM | | | | |
| 31 | | | 50 | SB-VRTB-04_30.5-34 @ 1442 | NM | | | | |
| 32 | | | | | NM | | | | |
| 33 | | | | | NM | | | | |
| 34 | | | | | NM | | | | |
| 35 | | | | | NM | | (34.0-40.0') SAND, fine, subrounded; some to little very fine sand; little to trace silt; well sorted; wet; pale brown (10YR 6/3). | | |
| 36 | | | 50 | | NM | | | | |
| 37 | | | | | NM | | | | |
| 38 | | | | | NM | | | | |
| 39 | | | | | NM | | | | |
| 40 | | | | | NM | | | | |
| 41 | | | | | | | (40.0-50.0') Blind drilled to install a fiber optic cable from 50 ft bgs to the surface for ADT-S testing in collaboration with the University of Guelph G360 Group. | | |

Remarks:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: SB-VRTB-04

Sheet: 3 of 3

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/16/2021
Date Completed: 09/16/2021

Logger: A. Westhuis
Editor: M. Humphrey
Weather Conditions: 75°F, Partly Cloudy

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 42 | | | | | | | (40.0-50.0') Blind drilled to install a fiber optic cable from 50 ft bgs to the surface for ADT-S testing in collaboration with the University of Guelph G360 Group. | (14.0-50.0' bgs) Natural Collapse. | |
| 43 | | | | | | | | | |
| 44 | | | | | | | | | |
| 45 | | | | | | | | | |
| 46 | | | | | | | | | |
| 47 | | | | | | | | | |
| 48 | | | | | | | | | |
| 49 | | | | | | | | | |
| 50 | | | | | | | | | |
| 51 | | | | | | | End of boring at 50.0' bgs. | | |
| 52 | | | | | | | General Notes:<br>VAP sampling completed on 9/13/2021 on intervals: (15.5-19.5), (19.5-23.5), (23.5-27.5), (29-33), and (36-40) ft bgs. All VAP Samples collected on 9/13/2021 from an adjacent borehole. | | |
| 53 | | | | | | | Pneumatic slug testing completed on 9/13/2021 on intervals: (36-40), (29-33), (23.5-27.5), and (19.5-23.5) ft bgs.<br>No pneumatic slug testing completed on (15.5-19.5) ft bgs interval. | | |
| 54 | | | | | | | VAP sampling and pneumatic slug testing both completed "bottom up". | | |
| 55 | | | | | | | Grain size samples submitted for soil sample intervals: (12-16.5), (17.5-20), (22.5-24.5), (26.5-27.5) and (30.5-34) ft bgs. | | |
| 56 | | | | | | | | | |
| 57 | | | | | | | | | |
| 58 | | | | | | | | | |
| 59 | | | | | | | | | |
| 60 | | | | | | | | | |
| 61 | | | | | | | | | |
| 62 | | | | | | | | | |

Remarks:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: MW-VRTB-01D

Sheet: 1 of 2

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/14/2021
Date Completed: 09/14/2021

Logger: M. Olender
Editor: A. Westhuis
Weather Conditions: 55°F, Sunny

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | NM | | (0.0-31.5') Blind drilled down to 31.5 ft bgs. No soils logged at MW-VRTB-1D. Well screen interval of 26.5-31.5 ft bgs determined based on information from HPT-VRTB-01. | (0.0-1.0' bgs) Flushmount | |
| 2 | | | | | NM | | | (1.0-2.0' bgs) Filter Pack Sand | |
| 3 | | | 60 | | NM | | | | |
| 4 | | | | | NM | | | | |
| 5 | | | | | NM | | | | |
| 6 | | | | | NM | | | (0.0-31.5') 8.0" dia. Drilled Hole | |
| 7 | | | | | NM | | | | |
| 8 | | | | | NM | | | | |
| 9 | | | | | NM | | | | |
| 10 | | | | | NM | | | | |
| 11 | | | | | NM | | | (2.0-24.5' bgs) Backfilled with Hydrated Bentonite Chips | |
| 12 | | | | | NM | | | | |
| 13 | | | | | NM | | | | |
| 14 | | | | | NM | | | | |
| 15 | | | | | NM | | | (0.0-26.5') 2.0" dia. SCH 40 PVC Casing | |
| 16 | | | | | NM | | | | |
| 17 | | | | | NM | | | | |
| 18 | | | | | NM | | | | |
| 19 | | | 318 | | NM | | | | |
| 20 | | | | | NM | | | | |

Drilling Co.: Cascade
Driller: R. Reagan
Drilling Method: Direct Push (Hollow Stem Augers for Well Installation)
Drilling Fluid: None
Remarks: bgs = below ground surface; NA = not applicable; btoc = below top of casing; ft = feet; NM= not measured.

Sampling Method: Hand Auger/Hollow Stem Auger
Sampling Interval: Continuous
Water Level Start (ft. bgs.): NA
Water Level Finish (ft. btoc.): 14.60
Converted to Well: ☒ Yes ☐ No
Surface Elev.:
North Coor:
East Coor:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: MW-VRTB-01D

Sheet: 2 of 2

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/14/2021
Date Completed: 09/14/2021

Logger: M. Olender
Editor: A. Westhuis
Weather Conditions: 55°F, Sunny

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 21 | | | | | NM | | (0.0-31.5') Blind drilled down to 31.5 ft bgs. No soils logged at MW-VRTB-1D. Well screen interval of 26.5-31.5 ft bgs determined based on information from HPT-VRTB-01. | (2.0-24.5' bgs) Backfilled with Hydrated Bentonite Chips | |
| 22 | | | | | NM | | | | |
| 23 | | | | | NM | | | | |
| 24 | | | | | NM | | | | |
| 25 | | | | | NM | | | (24.5-31.5' bgs) Filter Pack Sand | |
| 26 | | | | | NM | | | | |
| 27 | | | | | NM | | | | |
| 28 | | | | | NM | | | | |
| 29 | | | | | NM | | | (26.5-31.5' bgs) 2.0" dia. Stainless-Steel 0.010-Slot Screen | |
| 30 | | | | | NM | | | | |
| 31 | | | | | NM | | | | |
| 32 | | | | | | | | | |
| 33 | | | | | | | | | |
| 34 | | | | | | | | | |
| 35 | | | | | | | | | |
| 36 | | | | | | | | | |
| 37 | | | | | | | | | |
| 38 | | | | | | | | | |
| 39 | | | | | | | | | |
| 40 | | | | | | | | | |
| 41 | | | | | | | | | |

Remarks:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: MW-VRTB-01S

Sheet: 1 of 1

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/14/2021
Date Completed: 09/14/2021

Logger: M. Olender
Editor: A. Westhuis
Weather Conditions: 55°F, Sunny

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | 60 | | NM | | (0.0-20.0') Blind drilled down to 20.0 ft bgs. No soils logged at MW-VRTB-1S. Well screen interval of 15-20 ft bgs determined based on information from HPT-VRTB-01. | (0.0-1.0' bgs) Flushmount | |
| 2 | | | | | NM | | | (1.0-2.0' bgs) Filter Pack Sand | |
| 3 | | | | | NM | | | | |
| 4 | | | | | NM | | | (0.0-20.0') 8.0" dia. Drilled Hole | |
| 5 | | | | | NM | | | | |
| 6 | | | | | NM | | | | |
| 7 | | | | | NM | | | (2.0-13.0' bgs) Backfilled with Hydrated Bentonite Chips | |
| 8 | | | | | NM | | | | |
| 9 | | | | | NM | | | | |
| 10 | | | | | NM | | | (0.0-15.0') 2.0" dia. SCH 40 PVC Casing | |
| 11 | | | | | NM | | | | |
| 12 | | | 180 | | NM | | | | |
| 13 | | | | | NM | | | | |
| 14 | | | | | NM | | | (13.0-20.0' bgs) Filter Pack Sand. | |
| 15 | | | | | NM | | | | |
| 16 | | | | | NM | | | | |
| 17 | | | | | NM | | | (15.0-20.0' bgs) 2.0" dia. Stainless-Steel 0.010-Slot Screen | |
| 18 | | | | | NM | | | | |
| 19 | | | | | NM | | | | |
| 20 | | | | | NM | | | | |

Drilling Co.: Cascade
Driller: R. Reagan
Drilling Method: Direct Push (Hollow Stem Augers for Well Installation)
Drilling Fluid: None
Remarks: bgs = below ground surface; NA = not applicable; btoc = below top of casing; ft = feet; NM= not measured.

Sampling Method: Hand Auger/Hollow Stem Auger
Sampling Interval: Continuous
Water Level Start (ft. bgs.): NA
Water Level Finish (ft. btoc.): 14.26
Converted to Well: ☒ Yes ☐ No
Surface Elev.:
North Coor:
East Coor:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: MW-VRTB-02D

Sheet: 1 of 2

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/15/2021
Date Completed: 09/15/2021
Logger: A. Westhuis
Editor: A. Westhuis
Weather Conditions: 55°F, Sunny

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | NM | | (0.0-31.0') Blind drilled down to 31.0ft bgs. No soils logged at MW-VRTB-2D. Well screen interval of 26-31ft bgs determined based on information from HPT-VRTB-05. | (0.0-1.0' bgs) Flushmount | |
| 2 | | | | | NM | | | (1.0-2.0' bgs) Filter Pack Sand | |
| 3 | | | 60 | | NM | | | | |
| 4 | | | | | NM | | | | |
| 5 | | | | | NM | | | | |
| 6 | | | | | NM | | | (0.0-31.0') 8.0" dia. Drilled Hole | |
| 7 | | | | | NM | | | | |
| 8 | | | | | NM | | | | |
| 9 | | | | | NM | | | | |
| 10 | | | | | NM | | | | |
| 11 | | | | | NM | | | (2.0-24.0' bgs) Backfilled with hydrated Bentonite Chips | |
| 12 | | | | | NM | | | | |
| 13 | | | | | NM | | | | |
| 14 | | | | | NM | | | | |
| 15 | | | | | NM | | | | |
| 16 | | | | | NM | | | (0.0-26.0') 2.0" dia. SCH 40 PVC Casing | |
| 17 | | | | | NM | | | | |
| 18 | | | 312 | | NM | | | | |
| 19 | | | | | NM | | | | |
| 20 | | | | | NM | | | | |

Drilling Co.: Cascade
Driller: J. Ashe
Drilling Method: Direct Push (Hollow Stem Augers for Well Installation)
Drilling Fluid: None
Remarks: bgs = below ground surface; NA = not applicable; btoc = below top of casing; ft = feet; NM= not measured.

Sampling Method: Hand Auger/Hollow Stem Auger
Sampling Interval: Continuous
Water Level Start (ft. bgs.): NA
Water Level Finish (ft. btoc.): 14.56
Converted to Well: ☒ Yes ☐ No
Surface Elev.:
North Coor:
East Coor:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: MW-VRTB-02D

Sheet: 2 of 2

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/15/2021
Date Completed: 09/15/2021

Logger: A. Westhuis
Editor: A. Westhuis
Weather Conditions: 55°F, Sunny

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 21 | | | | | NM | | (0.0-31.0') Blind drilled down to 31.0ft bgs. No soils logged at MW-VRTB-2D. Well screen interval of 26-31ft bgs determined based on information from HPT-VRTB-05. | (2.0-24.0' bgs) Backfilled with hydrated Bentonite Chips | |
| 22 | | | | | NM | | | | |
| 23 | | | | | NM | | | | |
| 24 | | | | | NM | | | | |
| 25 | | | | | NM | | | (24.0-31.0' bgs) Filter Pack Sand | |
| 26 | | | | | NM | | | | |
| 27 | | | | | NM | | | | |
| 28 | | | | | NM | | | (26.0-31.0' bgs) 2.0" dia. Stainless-Steel 0.010-Slot Screen | |
| 29 | | | | | NM | | | | |
| 30 | | | | | NM | | | | |
| 31 | | | | | NM | | | | |
| 32 | | | | | | | | | |
| 33 | | | | | | | | | |
| 34 | | | | | | | | | |
| 35 | | | | | | | | | |
| 36 | | | | | | | | | |
| 37 | | | | | | | | | |
| 38 | | | | | | | | | |
| 39 | | | | | | | | | |
| 40 | | | | | | | | | |
| 41 | | | | | | | | | |

Remarks:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: MW-VRTB-02S

Sheet: 1 of 2

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/14/2021
Date Completed: 09/14/2021
Logger: A. Westhuis
Editor: A. Westhuis
Weather Conditions: 55°F, Sunny

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | NM | | (0.0-21.0') Blind drilled down to 21.0ft bgs. No soils logged at MW-VRTB-2S. Well screen interval of 16-21ft bgs determined based on information from HPT-VRTB-05. | (0.0-1.0' bgs) Flushmount | |
| 2 | | | | | NM | | | (1.0-2.0' bgs) Filter Pack Sand | |
| 3 | | | 60 | | NM | | | | |
| 4 | | | | | NM | | | | |
| 5 | | | | | NM | | | (0.0-21.0') 8.0" dia. Drilled Hole | |
| 6 | | | | | NM | | | | |
| 7 | | | | | NM | | | | |
| 8 | | | | | NM | | | (2.0-14.0' bgs) Backfilled with Hydrated Bentonite Chips | |
| 9 | | | | | NM | | | | |
| 10 | | | | | NM | | | | |
| 11 | | | | | NM | | | | |
| 12 | | | | | NM | | | (0.0-16.0') 2.0" dia. SCH 40 PVC Casing | |
| 13 | | | 192 | | NM | | | | |
| 14 | | | | | NM | | | | |
| 15 | | | | | NM | | | (14.0-21.0' bgs) Filter Pack Sand | |
| 16 | | | | | NM | | | | |
| 17 | | | | | NM | | | | |
| 18 | | | | | NM | | | | |
| 19 | | | | | NM | | | (16.0-21.0' bgs) 2.0" dia. Stainless-Steel 0.010-Slot Screen | |
| 20 | | | | | NM | | | | |

Drilling Co.: Cascade
Driller: J. Ashe
Drilling Method: Direct Push (Hollow Stem Augers for Well Installation)
Drilling Fluid: None
Remarks: bgs = below ground surface; NA = not applicable; btoc = below top of casing; ft = feet; NM= not measured.

Sampling Method: Hand Auger/Hollow Stem Auger
Sampling Interval: Continuous
Water Level Start (ft. bgs.): NA
Water Level Finish (ft. btoc.): 14.60
Converted to Well: ☒ Yes ☐ No
Surface Elev.:
North Coor:
East Coor:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: MW-VRTB-02S

Sheet: 2 of 2

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/14/2021
Date Completed: 09/14/2021

Logger: A. Westhuis
Editor: A. Westhuis
Weather Conditions: 55°F, Sunny

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 21 | | | | | NM | | (0.0-21.0') Blind drilled down to 21.0ft bgs. No soils logged at MW-VRTB-2S. Well screen interval of 16-21ft bgs determined based on information from HPT-VRTB-05. | | |
| 22 | | | | | | | | | |
| 23 | | | | | | | | | |
| 24 | | | | | | | | | |
| 25 | | | | | | | | | |
| 26 | | | | | | | | | |
| 27 | | | | | | | | | |
| 28 | | | | | | | | | |
| 29 | | | | | | | | | |
| 30 | | | | | | | | | |
| 31 | | | | | | | | | |
| 32 | | | | | | | | | |
| 33 | | | | | | | | | |
| 34 | | | | | | | | | |
| 35 | | | | | | | | | |
| 36 | | | | | | | | | |
| 37 | | | | | | | | | |
| 38 | | | | | | | | | |
| 39 | | | | | | | | | |
| 40 | | | | | | | | | |
| 41 | | | | | | | | | |

Remarks:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

ARCADIS Design & Consultancy for natural and built assets

# Soil Boring Log

Boring No.: MW-VRTB-03

Sheet: 1 of 1

Project Name: ESTCP GAAF
Project Number: 30027244
Project Location: Grayling, MI

Date Started: 09/15/2021
Date Completed: 09/15/2021

Logger: A. Westhuis
Editor: A. Westhuis
Weather Conditions: 55°F, Sunny

| Depth (feet) | Sample Interval | Blow Counts | Recovery (in.) | Sample ID | PID (ppm) | USCS Class | Description | Construction Details | Well |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | 60 | | NM | | (0.0-20.0') Blind drilled down to 20.0ft bgs. No soils logged at MW-VRTB-03. Well screen interval of 15-20ft bgs determined based on information from HPT-VRTB-06. | (0.0-1.0' bgs) Flushmount | |
| 2 | | | | | NM | | | (1.0-2.0' bgs) Filter Pack Sand | |
| 3 | | | | | NM | | | | |
| 4 | | | | | NM | | | (0.0-20.0') 8.0" dia. Drilled Hole | |
| 5 | | | | | NM | | | | |
| 6 | | | 180 | | NM | | | (2.0-13.0' bgs) Backfilled with Hydrated Bentonite Chips | |
| 7 | | | | | NM | | | | |
| 8 | | | | | NM | | | | |
| 9 | | | | | NM | | | (0.0-15.0') 2.0" dia. SCH 40 PVC Casing | |
| 10 | | | | | NM | | | | |
| 11 | | | | | NM | | | | |
| 12 | | | | | NM | | | | |
| 13 | | | | | NM | | | | |
| 14 | | | | | NM | | | (13.0-20.0' bgs) Filter Pack Sand | |
| 15 | | | | | NM | | | | |
| 16 | | | | | NM | | | | |
| 17 | | | | | NM | | | (15.0-20.0' bgs) 2.0" dia. Stainless-Steel 0.010-Slot Screen | |
| 18 | | | | | NM | | | | |
| 19 | | | | | NM | | | | |
| 20 | | | | | NM | | | | |

Drilling Co.: Cascade
Driller: J. Ashe
Drilling Method: Direct Push (Hollow Stem Augers for Well Installation)
Drilling Fluid: None
Remarks: bgs = below ground surface; NA = not applicable; btoc = below top of casing; ft = feet; NM= not measured.

Sampling Method: Hand Auger/Hollow Stem Auger
Sampling Interval: Continuous
Water Level Start (ft. bgs.): NA
Water Level Finish (ft. btoc.): 14.34
Converted to Well: ☒ Yes ☐ No
Surface Elev.:
North Coor:
East Coor:

SOIL BORING LOG_2013 C:\USERS\MHUMPHREY\DESKTOP\GRAYLING LOGS\GRAYLING AIRFIELD_UPDATED 011922.GPJ ARCADIS_2013.GDT 1/28/22

# APPENDIX F GRAIN SIZE ANALYSES AND HYDRAULIC CONDUCTIVITY ESTIMATES

# Appendix F

# Grain Size Analyses and Hydraulic Conductivity Estimates

## Introduction

During sonic coring at "golden spike" borehole SB-VRTB-03 a total of 50 samples were collected for grain size analyses in 100mL specimen jars over the depth interval from 8.0 – 37.0 ft bgs (**Table 1**). These were subjected to grain size analyses and subsequently the grain size distributions used to estimate hydraulic conductivity based on different empirical models presented in Devlin (2015).

## Methods

The samples collected in specimen jars were split via a quartering process and any larger cobbles removed that could skew the results. The split samples were then oven-dried providing dry sample masses between 54.0-136.1 g (average of 90.8 g) to be subjected to analysis. Samples were then wet-sieved through a #200 sieve (0.074mm) and dried again to provide the mass of fines (silt and clay sized particles). The remaining material was then dry-sieved through a series of 16 sieves (**Table 2**) using a mechanical shaker (**Figure 1**). Samples from each sieve were then weighed and the cumulative mass recovered compared with the initial dry sample mass after wet-sieving as a quality control check. Hydrometer analyses were not conducted on the fine fraction.

## Grain Size Results

Grain size distribution curves for all of the samples are plotted together in **Figure 2** showing ranges of grain size for gravel (>2 mm) and coarse – medium – fine sand (2.0 to 0.063mm) and silt / clay (<0.063mm). Split samples were also analyzed by a contract lab as well as samples from other boreholes using a sparser sieve-set. **Figure 3** shows a comparison of grain size distribution curves between the two analyses.

## Hydraulic Conductivity Estimates

An Excel based tool HydroGeoSieveXL (Devlin, 2015) was used to estimate hydraulic conductivity for samples based on the grain size distribution curves. Fifteen different estimation methods are used in the tool and produce a range of estimates; several of the methods have a range of applicable conditions. **Figures 4 and 5** show example reports of results of the grain size curves and hydraulic conductivity estimates, respectively, using the publicly available version of the Excel Tool: https://kuscholarworks.ku.edu/handle/1808/21763. Arcadis also has a proprietary version of the code with additional automation of the process.

## References

Devlin, J.F., 2015. HydroGeoSieveXL: an Excel-based tool to estimate hydraulic conductivity from grain-size analysis. Hydrogeol J 23, 837–844. https://doi.org/10.1007/s10040-015-1255-0

**Table 1**: **Samples collected for grain size analyses from "golden spike" borehole VRTB-03**

| Sample Number | Boring ID | Sample ID | Top (ft bgs) | Bottom (ft bgs) | Date | Time | Matrix | Specimen Jar | 4 oz Glass Jar |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SB-VRTB-03 | SB-VRTB-03_8-8.5 | 8.0 | 8.5 | 2021-09-15 | 8:45 | Soil | X | |
| 2 | SB-VRTB-03 | SB-VRTB-03_9-9.5 | 9.0 | 9.5 | 2021-09-15 | 8:46 | Soil | X | |
| 3 | SB-VRTB-03 | SB-VRTB-03_10-10.5 | 10.0 | 10.5 | 2021-09-15 | 8:47 | Soil | X | |
| 4 | SB-VRTB-03 | SB-VRTB-03_10.5-11 | 10.5 | 11.0 | 2021-09-14 | 12:15 | Soil | X | X |
| 5 | SB-VRTB-03 | SB-VRTB-03_11-11.5 | 11.0 | 11.5 | 2021-09-15 | 8:48 | Soil | X | |
| 6 | SB-VRTB-03 | SB-VRTB-03_11.5-12 | 11.5 | 12.0 | 2021-09-14 | 12:20 | Soil | X | X |
| 7 | SB-VRTB-03 | SB-VRTB-03_12-12.5 | 12.0 | 12.5 | 2021-09-15 | 8:49 | Soil | X | |
| 8 | SB-VRTB-03 | SB-VRTB-03_12.5-13 | 12.5 | 13.0 | 2021-09-15 | 8:50 | Soil | X | |
| 9 | SB-VRTB-03 | SB-VRTB-03_13-13.5 | 13.0 | 13.5 | 2021-09-14 | 12:35 | Soil | X | |
| 10 | SB-VRTB-03 | SB-VRTB-03_13.5-14 | 13.5 | 14.0 | 2021-09-15 | 8:51 | Soil | X | |
| 11 | SB-VRTB-03 | SB-VRTB-03_14-14.5 | 14.0 | 14.5 | No Specimen Jar Collected - Insufficent Soil | | | | |
| 12 | SB-VRTB-03 | SB-VRTB-03_14.5-15 | 14.5 | 15.0 | 2021-09-15 | 8:52 | Soil | X | |
| 13 | SB-VRTB-03 | SB-VRTB-03_15-15.5 | 15.0 | 15.5 | 2021-09-15 | 8:53 | Soil | X | |
| 14 | SB-VRTB-03 | SB-VRTB-03_15.5-16 | 15.5 | 16.0 | 2021-09-15 | 8:54 | Soil | X | |
| 15 | SB-VRTB-03 | SB-VRTB-03_16-16.5 | 16.0 | 16.5 | 2021-09-15 | 8:55 | Soil | X | |
| 16 | SB-VRTB-03 | SB-VRTB-03_16.5-17 | 16.5 | 17.0 | 2021-09-14 | 14:30 | Soil | X | |
| 17 | SB-VRTB-03 | SB-VRTB-03_17-17.5 | 17.0 | 17.5 | 2021-09-15 | 8:56 | Soil | X | |
| 18 | SB-VRTB-03 | SB-VRTB-03_17.5-18 | 17.5 | 18.0 | 2021-09-15 | 8:57 | Soil | X | |
| 19 | SB-VRTB-03 | SB-VRTB-03_18-18.5 | 18.0 | 18.5 | 2021-09-15 | 8:58 | Soil | X | |
| 20 | SB-VRTB-03 | SB-VRTB-03_18.5-19 | 18.5 | 19.0 | 2021-09-15 | 8:59 | Soil | X | |
| 21 | SB-VRTB-03 | SB-VRTB-03_19-19.5 | 19.0 | 19.5 | 2021-09-14 | 14:48 | Soil | X | |
| 22 | SB-VRTB-03 | SB-VRTB-03_19.5-20 | 19.5 | 20.0 | 2021-09-14 | 15:02 | Soil | X | |
| 23 | SB-VRTB-03 | SB-VRTB-03_20-20.5 | 20.0 | 20.5 | 2021-09-15 | 9:00 | Soil | X | |
| 24 | SB-VRTB-03 | SB-VRTB-03_20.5-21 | 20.5 | 21.0 | 2021-09-15 | 9:01 | Soil | X | |
| 25 | SB-VRTB-03 | SB-VRTB-03_21-21.5 | 21.0 | 21.5 | 2021-09-15 | 9:02 | Soil | X | |
| 26 | SB-VRTB-03 | SB-VRTB-03_21.5-22 | 21.5 | 22.0 | 2021-09-15 | 9:03 | Soil | X | |
| 27 | SB-VRTB-03 | SB-VRTB-03_22-22.5 | 22.0 | 22.5 | 2021-09-15 | 9:04 | Soil | X | |
| 28 | SB-VRTB-03 | SB-VRTB-03_22.5-23 | 22.5 | 23.0 | 2021-09-14 | 15:55 | Soil | X | X |
| 29 | SB-VRTB-03 | SB-VRTB-03_23-23.5 | 23.0 | 23.5 | 2021-09-15 | 9:05 | Soil | X | |
| 30 | SB-VRTB-03 | SB-VRTB-03_23.5-24 | 23.5 | 24.0 | 2021-09-15 | 9:06 | Soil | X | |
| 31 | SB-VRTB-03 | SB-VRTB-03_24-24.5 | 24.0 | 24.5 | 2021-09-15 | 9:07 | Soil | X | |
| 32 | SB-VRTB-03 | SB-VRTB-03_24.5-25 | 24.5 | 25.0 | 2021-09-14 | 16:03 | Soil | X | X |
| 33 | SB-VRTB-03 | SB-VRTB-03_25-25.5 | 25.0 | 25.5 | 2021-09-15 | 9:52 | Soil | X | |
| 34 | SB-VRTB-03 | SB-VRTB-03_25.5-26 | 25.5 | 26.0 | 2021-09-15 | 9:53 | Soil | X | |
| 35 | SB-VRTB-03 | SB-VRTB-03_26-26.5 | 26.0 | 26.5 | 2021-09-15 | 9:40 | Soil | X | |
| 36 | SB-VRTB-03 | SB-VRTB-03_26.5-27 | 26.5 | 27.0 | 2021-09-15 | 9:54 | Soil | X | |
| 37 | SB-VRTB-03 | SB-VRTB-03_27-27.5 | 27.0 | 27.5 | 2021-09-15 | 9:50 | Soil | X | X |
| 38 | SB-VRTB-03 | SB-VRTB-03_30-30.5 | 30.0 | 30.5 | 2021-09-15 | 10:45 | Soil | X | |
| 39 | SB-VRTB-03 | SB-VRTB-03_30.5-31 | 30.5 | 31.0 | 2021-09-15 | 11:03 | Soil | X | |
| 40 | SB-VRTB-03 | SB-VRTB-03_31-31.5 | 31.0 | 31.5 | 2021-09-15 | 11:04 | Soil | X | |
| 41 | SB-VRTB-03 | SB-VRTB-03_31.5-32 | 31.5 | 32.0 | 2021-09-15 | 11:05 | Soil | X | |
| 42 | SB-VRTB-03 | SB-VRTB-03_32-32.5 | 32.0 | 32.5 | 2021-09-15 | 11:06 | Soil | X | |
| 43 | SB-VRTB-03 | SB-VRTB-03_32.5-33 | 32.5 | 33.0 | 2021-09-15 | 11:07 | Soil | X | |
| 44 | SB-VRTB-03 | SB-VRTB-03_33-33.5 | 33.0 | 33.5 | 2021-09-15 | 11:08 | Soil | X | |
| 45 | SB-VRTB-03 | SB-VRTB-03_33.5-34 | 33.5 | 34.0 | 2021-09-15 | 11:09 | Soil | X | |
| 46 | SB-VRTB-03 | SB-VRTB-03_34-34.5 | 34.0 | 34.5 | 2021-09-15 | 11:10 | Soil | X | |
| 47 | SB-VRTB-03 | SB-VRTB-03_34.5-35 | 34.5 | 35.0 | 2021-09-15 | 11:11 | Soil | X | |
| 48 | SB-VRTB-03 | SB-VRTB-03_35-35.5 | 35.0 | 35.5 | 2021-09-15 | 11:50 | Soil | X | |
| 49 | SB-VRTB-03 | SB-VRTB-03_35.5-36 | 35.5 | 36.0 | 2021-09-15 | 11:51 | Soil | X | |
| 50 | SB-VRTB-03 | SB-VRTB-03_36-36.5 | 36.0 | 36.5 | 2021-09-15 | 11:42 | Soil | X | |
| 51 | SB-VRTB-03 | SB-VRTB-03_36.5-37 | 36.5 | 37.0 | 2021-09-15 | 11:52 | Soil | X | |

**Table 2**: **Sieve sizes used for grain size analyses**

| Sieve No. | Diameter (mm) |
|---|---|
| 5 | 4.00 |
| 7 | 2.80 |
| 10 | 2.00 |
| 14 | 1.40 |
| 18 | 1.00 |
| 25 | 0.710 |
| 35 | 0.500 |
| 45 | 0.355 |
| 60 | 0.250 |
| 70 | 0.212 |
| 80 | 0.180 |
| 100 | 0.150 |
| 120 | 0.125 |
| 140 | 0.106 |
| 170 | 0.090 |
| 200 | 0.075 |



**Figure 1**: **Sieve set and mechanical shaker for grain size analyses**

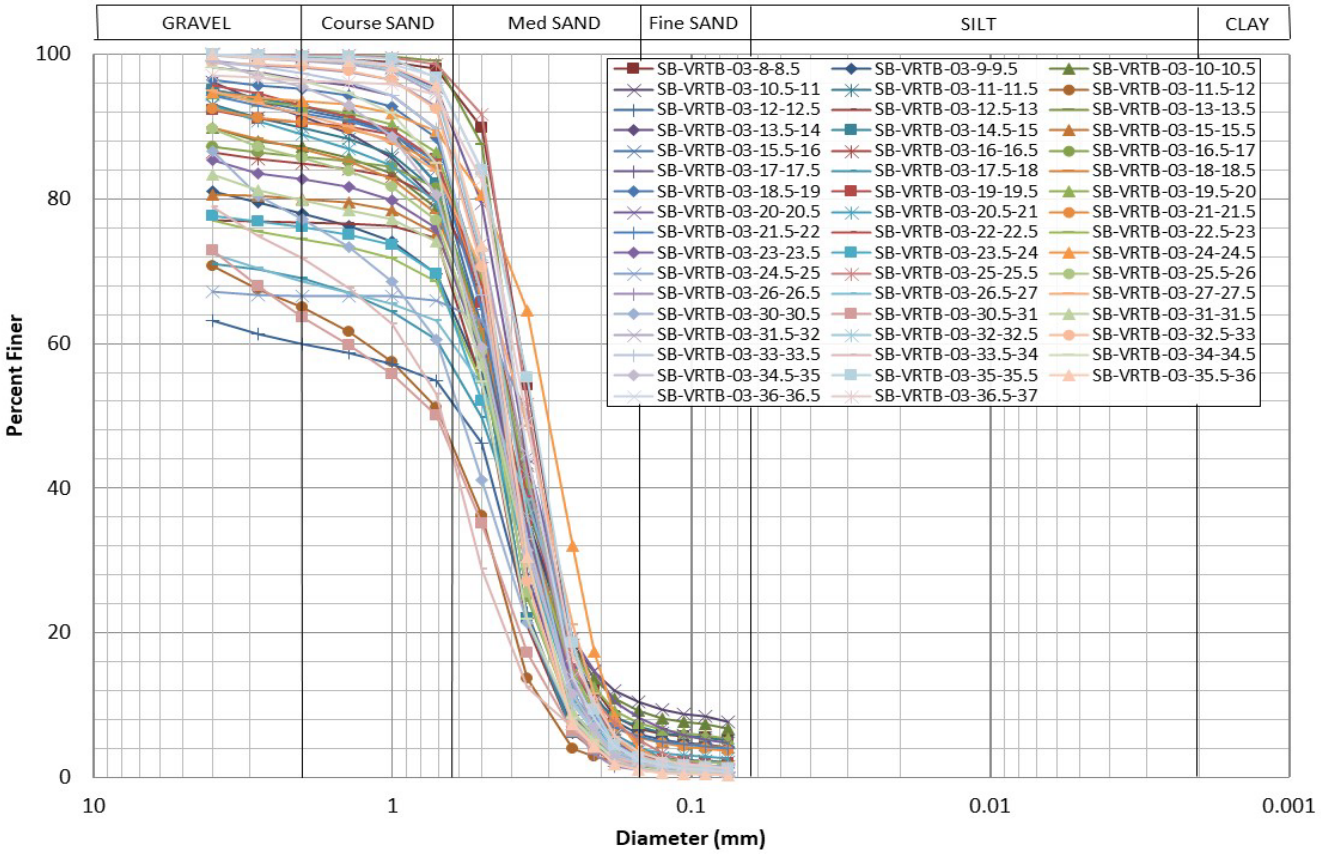



**Figure 2**: **Grain size distribution curves for "golden spike" borehole SB-VRTB-03**

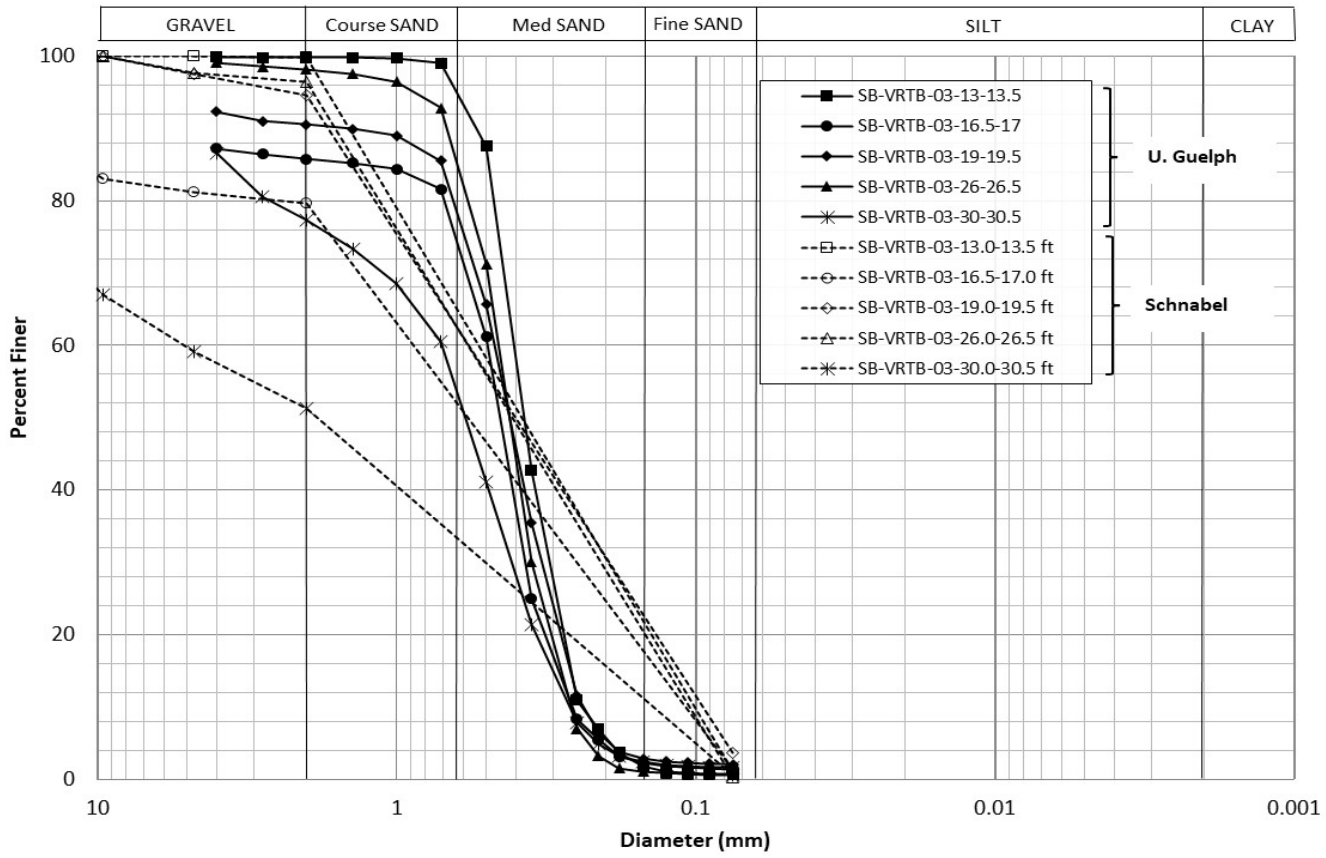


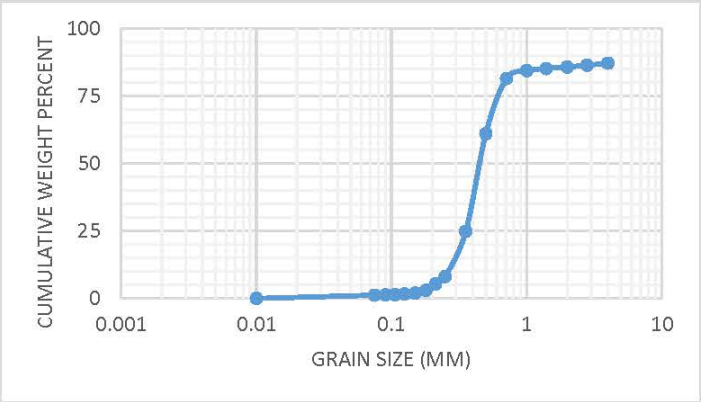

**Figure 3**: **Comparison of grain size results from the "golden spike" borehole VRTB-03 analyzed by U. Guelph using a more detailed sieve-set versus splits analyzed by contract lab**

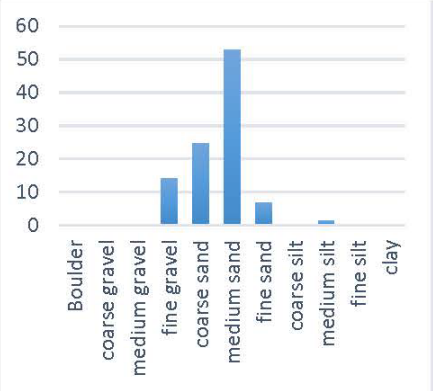
Grain Size Analysis Report  Date: 3-Mar-22

Sample Name: SB-VRTB-03-16.5-17_VRTB-0015

Mass Sample (g): 86.026  T (oC) 20

## Uniform gravelly sand low in fines




| Sieve opening (ps) di (mm) | Mass of retained (mr) (g) | mass fraction (mf) | Percent Passing (pp) |
|---|---|---|---|
| 4 | 11.02 | 0.128101 | 87.18992 |
| 2.8 | 0.666 | 0.007742 | 86.41573 |
| 2 | 0.554 | 0.00644 | 85.77174 |
| 1.4 | 0.464 | 0.005394 | 85.23237 |
| 1 | 0.736 | 0.008556 | 84.37682 |
| 0.71 | 2.411 | 0.028026 | 81.57418 |
| 0.5 | 17.604 | 0.204636 | 61.11059 |
| 0.355 | 31.169 | 0.362321 | 24.87853 |
| 0.25 | 14.37 | 0.167043 | 8.174273 |
| 0.212 | 2.442 | 0.028387 | 5.335596 |
| 0.18 | 2.018 | 0.023458 | 2.989794 |
| 0.15 | 0.788 | 0.00916 | 2.073792 |
| 0.125 | 0.361 | 0.004196 | 1.654151 |
| 0.106 | 0.155 | 0.001802 | 1.473973 |
| 0.09 | 0.115 | 0.001337 | 1.340292 |
| 0.075 | 0.075 | 0.000872 | 1.25311 |
| 0.01 | 1.078 | 0.012531 | 0 |

| Effective Grain Diameters (mm) | |
|---|---|
| d10 | 0.261 |
| d17 | 0.305 |
| d20 | 0.324 |
| d50 | 0.456 |
| d60 | 0.496 |
| de (Kruger) | 0.408 |
| de (Kozeny) | 0.342 |
| de (Zunker) | 0.366 |
| de (Zamarin) | 0.390 |
| Io (Alyameni) | -1.679 |

| Other Useful Parameters | |
|---|---|
| Uniformity Coef. | 1.90 |
| n computed | 0.43 |
| g ($cm/s^2$) | 980.00 |
| ρ ($g/cm^3$) | 0.9981 |
| μ (g/cm s) | 0.0098 |
| ρg/μ (1/cm s) | 9.9327E+04 |
| tau (Sauerbrei) | 1.053 |
| $d_{geometric\,mean}$ | 0.465 |
| $\sigma_\phi$ | 1.086 |

| mm | 0 | % in sample |
|---|---|---|
| >64 | Boulder | |
| 16 - 64 | coarse gravel | |
| 8 - 16 | medium gravel | |
| 2 - 8 | fine gravel | 14.22825657 |
| 0.5 - 2 | coarse sand | 24.66114895 |
| 0.25 - 0.5 | medium sand | 52.93632158 |
| 0.063 - 0.25 | fine sand | 6.921163369 |
| 0.016 - 0.063 | coarse silt | |
| 0.008 - 0.016 | medium silt | 1.253109525 |
| 0.002 - 0.008 | fine silt | |
| <0.002 | clay | |

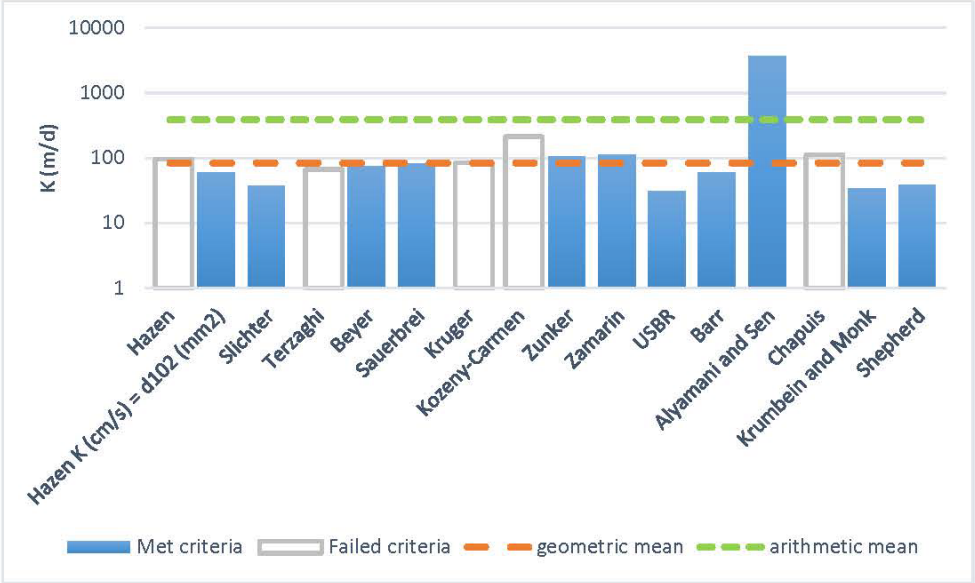
**Figure 4: Example HydrogeoSieve XL output for grain size analyses**

*K* from Grain Size Analysis Report  Date: 3-Mar-22

Sample Name: SB-VRTB-03-16.5-17_VRTB-0015

Mass Sample (g): 86.026  T (oC) 20

Uniform gravelly sand low in fines




| Estimation of Hydraulic Conductivity | cm/s | m/s | m/d | de |
|---|---|---|---|---|
| Hazen | .112E+00 | .112E-02 | 96.51 | |
| Hazen K (cm/s) = $d_{10}$ (mm) | .684E-01 | .684E-03 | 59.07 | |
| Slichter | .437E-01 | .437E-03 | 37.78 | |
| Terzaghi | .771E-01 | .771E-03 | 66.64 | |
| Beyer | .855E-01 | .855E-03 | 73.88 | |
| Sauerbrei | .935E-01 | .935E-03 | 80.81 | |
| Kruger | .976E-01 | .976E-03 | 84.37 | |
| Kozeny-Carmen | .247E+00 | .247E-02 | 213.27 | |
| Zunker | .121E+00 | .121E-02 | 104.96 | |
| Zamarin | .130E+00 | .130E-02 | 112.49 | |
| USBR | .358E-01 | .358E-03 | 30.91 | |
| Barr | .698E-01 | .698E-03 | 60.27 | |
| Alyamani and Sen | .422E+01 | .422E-01 | 3644.12 | |
| Chapuis | .130E+00 | .130E-02 | 112.72 | |
| Krumbein and Monk | .388E-01 | .388E-03 | 33.49 | |
| Shepherd | .452E-01 | .452E-03 | 39.02 | |
| geometric mean | .968E-01 | .968E-03 | 83.61 | |
| arithmetic mean | .450E+00 | .450E-02 | 388.80 | |

**Figure 5: Example HydrogeoSieve XL output for hydraulic conductivity estimates**

# APPENDIX G VERTEBRAE WELL SYSTEM PFAS MATERIALS TESTING

July 7, 2023

Craig Divine PG, PhD
Principal Hydrogeologist, Vice President
Arcadis U.S., Inc.
320 Commerce, Suite 200 | Irvine, CA | 92602 | USA
M +1 720 308 5367

**RE: Results of Vertebrae Well System PFAS materials testing**

Greetings Mr. Divine,

EN Rx, Inc. is pleased to report the following background, methodology, and results from our PFAS compounds testing of the Vertebrae® Well System (VWS) materials in support of ESTCP project ER20-5026.

## Background

VWS were proposed to be utilized for PFAS compounds sampling at Grayling Army Airfield. To address the PFAS contaminants of concern EN Rx developed a testing protocol for the materials utilized in the construction of the VWS. This is intended to verify that the materials used in the VWS do not present the potential to affect groundwater sample quality. The primary mechanisms for the potential impacts would be leaching PFAS from the well materials resulting in increased groundwater concentrations reported. Laboratory-based experiments were completed and focused on key VWS components for these purposes. Laboratory Analysis was limited to the 28 primary PFAS compounds commonly quantified by USEPA Method 537.1.

## Initial Sample Collection and Analysis

Six initial "coupon" size samples, one from each of the well materials, were collected. These coupons were a small portion of all materials used in the general construction of the well systems. These materials are:

- polyester geotextile screen wrap (sock)
- tie-nylon wrap (plastic tie wraps)
- well screen-polyethylene (proprietary product design)

- nylon pull tape measure, printed (also known as Ribbon of Mule Tape)
- riser-HDPE tubing ½" (we also use ¾", 1", 1.25", and 1.5: risers from the same manufacturer )
- sleeve-HDPE 3" (Conduit – SDR 13.5 (we also use 4"and 5" sleeves)

These samples were collected on July 17, 2019, by trained technicians from new stock, using PFAS free gloves, clean cuttings tools, and individual bags. The bags were placed in a box and shipped to the chosen analytical laboratory.

Samples of the six well materials were initially tested at Eurofins Laboratories, Lancaster PA, and established baseline values for the 28 PFAS compounds as solids requiring methanol extraction. The laboratory reports are included as **Appendix A**. The complete lists are reported on the report. Analytical results of the initial testing identified four PFAS compounds above laboratory detection limits associated with the nylon pull tape, tie wrap and the geotextile fabric (polyester sock). Laboratory analytical results indicated the presence of 6:2-Fluorotelomersulfonic acid, 4:2-Fluorotelomersulfonic acid, Perflouroheptanesulfonic acid, Perfluorohexanoic acid, and Perfluoropentanoic acid. Primarily, the main exceedance observed above the laboratory detection limit was centered around a single compound 6:2-Fluorotelomersulfonic (FTS) acid at 2000 ng/g (nanogram/gram) which was several magnitudes above the other constituents, which were reported at trace concentrations 3.9, 0.18, 0.33, and 0.20 ng/g, respectively. Laboratory results are summarized for 6:2 FTS in **Table 1**.

Due to the detection of 6:2 FTS in three of the coupon samples a pre-cleaning procedure was designed to remove the COCs. The pre-cleaning protocol involved three sequential rinses with 1-liter of methanol per rinse. The samples were allowed to dry in open air, and then were bagged as before. Following the pre-cleaning protocol, a second set of samples, for the geotextile sock, the nylon pull tape, and the tie wrap, were collected on September 5, 2019 and shipped to Eurofins Laboratories, Lancaster PA for laboratory analysis.

Laboratory results from the post cleaning indicated excellent removal of the 6:2 FTS. Laboratory results are included as **Appendix B.** All 28 compounds were non-detect for the geotextile sock and the tie wrap. There was one trace detection of Perfluorooctanesulfonic acid (PFOS) at 0.77 ng/g. This was unexplained as the compound was not previously detected in the baseline sampling could have been cross contamination from another source.

Based on the non-detect analytical results of the pre-cleaned samples for the initially detected compounds, it was determined that the pre-cleaning protocol of the VWS well materials successfully addressed the identified PFAS compounds and this method was utilized for the field system deployed at Grayling Army Airfield (GAFF).

**Table 1**

PFAS Free Test Results for 6:2-Fluorotelomersulfonic acid

| VWS Well Material Component | Initial Sampling Results | Post Pre-Cleaning Results |
|---|---|---|
| Sleeve-HDPE 3” | ND | ND |
| Tie-Nylon Wrap | 73 ng/g | ND |
| Gotextile Screen Wrap Sock | 2000 ng/g | ND |
| Riser-HDPE Tubing 1/2 | ND | ND |
| Well Screen-Polyethylene Proprietary Design | ND | ND |
| Nylon Pull Tape Measure- Printed* | 1600 ng/g | ND |

*ND = Non-detect - ng/g (nanogram/gram) - * Subsequently this product was removed from the build for this project.*

**Normal Wash Characteristics**

Due to the analytical results provided in the initial sampling VWS material testing, it is understood there may be PFAS compounds on the geotextile and the pull tape. However, to determine if these PFAS compounds would regularly dissolve off of the geotextile and end up as a reported concentration in collected groundwater samples, a simple rinsate sample was completed.

This test was completed with a geotextile sample submitted to AEL Jacksonville. This sample was rinsed with deionized water. This rinse was sampled using groundwater sampling protocol. The laboratory report is provided in **Appendix C**.

Results indicated that Perfluorooctanoic Acid (PFOA) did rinse into the water at 0.97 ng/g. No other compounds were above the detection limits. See the AEL laboratory report and sample labeled Sock Rinsate DI H2O, collected January 06, 2023.

This PFOA is believed to be cross contamination as it was not detected in the more rigorous method extraction procedure, reported above from initial coupon samples.

Also, the results appear to indicate despite the concentrations detected initially on the geotextile for 6:2 FTS, it is unlikely this compound readily is removed with water and likely to be a reported byproduct of normal geotextile installation.

**Well System Construction Changes**

The well system construction proceeded given the laboratory results and the additional testing which demonstrated that the compounds would not leach by water alone. A successful precleaning procedure was completed for the geotextile and zip ties. However, the nylon pull tape integrated into the system is a tightly woven fabric not as amenable to rising (washing) as the geotextile sock and tie wraps. It also accounted for the laboratory result of Perfluorooctanesulfonic acid (PFOS) post pre-cleaning. For the purposes of this installation for ESTCP, a tracer was to be utilized for locating the well system. ProTrace® wire has markings on it to allow for the measuring of the wells system and thus the measuring tape was not needed and was removed from the well system.

With the above changes three VWS were constructed from October 4, 2021 to October 7, 2021 using cleaned geotextile and tie wraps, tracer wire, and the typical construction sleeve, screen and riser. The wells were shipped to the site and installed.

**Positive Bias Analytical Sampling**

The well materials were also submitted for a positive bias testing. The main well material of suspected ability to positively bias the groundwater sampling is the geotextile fabric. This material was sent to AEL in Jacksonville Florida for analytical laboratory testing.

The protocol for this analysis was to pre-sample the geotextile for PFAS to ensure PFAS concentration was known prior to the testing. The geotextile was prewashed with methanol to ensure a lack of PFAS before testing. The sample did not have any detectable PFAS compounds tested for at the detection limits of the sample. See the AEL lab report and sample labeled sock, collected January 06, 2023.

Then the geotextile was soaked in a PFAS spike solution for 72 hrs to allow for adsorption or adhesion. This solution consisted of the compounds listed on Page 14 of the report (spiked compounds). Then the sock was rinsed three times in deionized water. Finally, the sock was resampled for PFAS compounds using standard solids (soil) methodology. The following results were reported after this this process.

**Table 2**
PFAS Test Results for Positive Bias

| Compound | Result | Unit |
|---|---|---|
| FOSA | 4.5 – i | ppt |
| PFTeDA | 47 | ppt |
| PFTrDA | 13 | ppt |

Three components appear to have an adsorptive capability with the geotextile fiber; FOSA – Perflourooctanesulfonamide (PFOSA), PFTrDA, and PFTeDA. PFTeDA reported the most effect. The FOSA has the least detectable effect. It should be noted these compounds required methanol (solvent) extraction to remove them from the geotextile, so it is unknown if this phenomena would occur in-situ, but it is clear that some PFAS compounds will be more adsorptive than others and could have this effect.

**Conclusions**

The current construction of Vertebrae Well Systems includes in part, material that are likely coated in a PFAS related compound resulting in 6:2 FTS concentration in samples collected from the construction materials (measuring ribbon, geotextile sock, and nylon tie wraps). The tape measure can be removed from the process and the sock and tie wrap can be thoroughly cleaned. Based on the data collected in this study, the VWS well systems can be tested prior to production for certification to be free of primary PFAS type analytes.

It is believed the well material cleaning process is unnecessary given the lack of PFAS compounds that would easily be dissolved into groundwater based on the rinsate sampling. Methanol extraction is aggressive and doesn't represent general groundwater chemistry. However, this can be completed as protocol based on client requirements.

Positive bias testing also reported compounds that can adhere/adsorb and withstand the normal water washing that may occur at sites allowing for the possibility of positive biased sampling of three PFAS compounds. However, no further study was conducted, and these three compounds were not reported at applicable levels at the site.

Thank you for the opportunity to complete this testing and work on the project. Please let us know if there are any questions or concerns.

Sincerely,
**The EN Rx Team**



Lance I. Robinson

President

EN Rx, Inc.

# Appendix A

eurofins | Lancaster Laboratories Environmental

2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-6766 • www.EurofinsUS.com/LancLabsEnv



REVISED

# ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ENRX, Inc.
PO Box 27056
Flower Mound TX 75027

Report Date: August 09, 2019 13:51

**Project: PFOA/PFOS Analysis**

Account #: 44646
Group Number: 2055933
PO Number: SK 001
State of Sample Origin: PA

| | | |
|---|---|---|
| Electronic Copy To | ENRX, Inc. | Attn: Stephen Koenigsberg |
| Electronic Copy To | ENRX, Inc. | Attn: Lance Robinson |
| Electronic Copy To | ENRX, Inc. | Attn: Erik Piatt |

Respectfully Submitted,

Marrissa Williams
Project Manager

(717) 556-7246

A previous version of this report was generated on 08/06/2019 16:45.

To view our laboratory's current scopes of accreditation please go to https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/ . Historical copies may be requested through your project manager.

eurofins | Lancaster Laboratories Environmental

2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-6766 • www.EurofinsUS.com/LancLabsEnv



REVISED

## SAMPLE INFORMATION

| Client Sample Description | Sample Collection Date/Time | ELLE# |
|---|---|---|
| Sleeve-HDPE 3" Solid | NA | 1112177 |
| Tie-Nylon Tie Wrap Solid | NA | 1112178 |
| Sock-Polyester Geotextile Solid | NA | 1112179 |
| Riser-HDPE Tubing 1/2" Solid | NA | 1112180 |
| Screen-PE Corregated Solid | NA | 1112181 |
| Tape-Nylon Pule Mule Tape Printed Solid | NA | 1112182 |

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

REVISED

**Sample Description:** **Sleeve-HDPE 3" Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112177**
**ELLE Group #: 2055933**
**Matrix: Solid**

| CAT No. | Analysis Name | CAS Number | As Received Result | As Received Limit of Quantitation | Dilution Factor |
|---|---|---|---|---|---|
| **LC/MS/MS Miscellaneous** | **EPA 537 Version 1.1 Modified** | | **ng/g** | **ng/g** | |
| 14027 | 10:2Fluorotelomersulfonic acid | 120226-60-0 | < 0.020 Z | 0.020 | 1 |
| 14027 | 4:2-Fluorotelomersulfonic acid | 757124-72-4 | < 0.020 Q0 | 0.020 | 1 |
| 14027 | 6:2-Fluorotelomersulfonic acid | 27619-97-2 | < 0.020 | 0.020 | 1 |
| 14027 | 8:2-Fluorotelomersulfonic acid | 39108-34-4 | < 0.030 | 0.030 | 1 |
| 14027 | NEtFOSAA | 2991-50-6 | < 0.020 | 0.020 | 1 |
| | NEtFOSAA is the acronym for N-ethyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | NMeFOSAA | 2355-31-9 | < 0.020 | 0.020 | 1 |
| | NMeFOSAA is the acronym for N-methyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | Perfluorobutanesulfonic acid | 375-73-5 | < 0.020 | 0.020 | 1 |
| 14027 | Perfluorobutanoic acid | 375-22-4 | < 0.020 | 0.020 | 1 |
| 14027 | Perfluorodecanesulfonic acid | 335-77-3 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluorodecanoic acid | 335-76-2 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluorododecanesulfonic acid | 79780-39-5 | < 0.020 | 0.020 | 1 |
| 14027 | Perfluorododecanoic acid | 307-55-1 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluoroheptanesulfonic acid | 375-92-8 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluoroheptanoic acid | 375-85-9 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluorohexadecanoic acid | 67905-19-5 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluorohexanesulfonic acid | 355-46-4 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluorohexanoic acid | 307-24-4 | 0.0084 | 0.0061 | 1 |
| 14027 | Perfluorononanesulfonic acid | 68259-12-1 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluorononanoic acid | 375-95-1 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluorooctadecanoic acid | 16517-11-6 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluorooctanesulfonamide | 754-91-6 | < 0.0061 Q0 | 0.0061 | 1 |
| 14027 | Perfluorooctanesulfonic acid | 1763-23-1 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluorooctanoic acid | 335-67-1 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluoropentanesulfonate | 2706-91-4 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluoropentanoic acid | 2706-90-3 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluorotetradecanoic acid | 376-06-7 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluorotridecanoic acid | 72629-94-8 | < 0.0061 | 0.0061 | 1 |
| 14027 | Perfluoroundecanoic acid | 2058-94-8 | < 0.0061 | 0.0061 | 1 |

The stated QC limits are advisory only until sufficient data points can be obtained to calculate statistical limits.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits as noted on the QC Summary.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits in the method blank and Laboratory Control Sample Duplicate (LCSD) as noted on the QC Summary.

Z=The response for a target analyte(s) in the closing continuing calibration verification standard is outside the QC acceptance limits. Since the response is high indicating increased sensitivity, and the target analyte(s) is not detected in the sample, the data is reported.

The inital weight of the sample was 230.63 grams.

eurofins | Lancaster Laboratories Environmental

2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-6766 • www.EurofinsUS.com/LancLabsEnv

# Analysis Report

REVISED

**Sample Description:** **Sleeve-HDPE 3" Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112177**
**ELLE Group #: 2055933**
**Matrix: Solid**

## Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

## Laboratory Sample Analysis Record

| CAT No. | Analysis Name | Method | Trial# | Batch# | Analysis Date and Time | Analyst | Dilution Factor |
|---|---|---|---|---|---|---|---|
| 14027 | 28 PFAS in Soil | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/04/2019 21:52 | Jason W Knight | 1 |
| 14090 | PFAS Solid Prep | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/01/2019 08:00 | Robert Brown | 1 |

REVISED

**Sample Description:** **Tie-Nylon Tie Wrap Solid PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112178**
**ELLE Group #: 2055933**
**Matrix: Solid**

| CAT No. | Analysis Name | CAS Number | As Received Result | As Received Limit of Quantitation | Dilution Factor |
|---|---|---|---|---|---|
| **LC/MS/MS Miscellaneous** | **EPA 537 Version 1.1 Modified** | | **ng/g** | **ng/g** | |
| 14027 | 10:2Fluorotelomersulfonic acid | 120226-60-0 | < 1.1 Z | 1.1 | 1 |
| 14027 | 4:2-Fluorotelomersulfonic acid | 757124-72-4 | < 1.1 Q0 | 1.1 | 1 |
| 14027 | 6:2-Fluorotelomersulfonic acid | 27619-97-2 | 73 | 1.1 | 1 |
| 14027 | 8:2-Fluorotelomersulfonic acid | 39108-34-4 | < 1.7 | 1.7 | 1 |
| 14027 | NEtFOSAA | 2991-50-6 | < 1.1 | 1.1 | 1 |
| | NEtFOSAA is the acronym for N-ethyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | NMeFOSAA | 2355-31-9 | < 1.1 | 1.1 | 1 |
| | NMeFOSAA is the acronym for N-methyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | Perfluorobutanesulfonic acid | 375-73-5 | < 1.1 | 1.1 | 1 |
| 14027 | Perfluorobutanoic acid | 375-22-4 | < 1.1 | 1.1 | 1 |
| 14027 | Perfluorodecanesulfonic acid | 335-77-3 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorodecanoic acid | 335-76-2 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorododecanesulfonic acid | 79780-39-5 | < 1.1 | 1.1 | 1 |
| 14027 | Perfluorododecanoic acid | 307-55-1 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluoroheptanesulfonic acid | 375-92-8 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluoroheptanoic acid | 375-85-9 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorohexadecanoic acid | 67905-19-5 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorohexanesulfonic acid | 355-46-4 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorohexanoic acid | 307-24-4 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorononanesulfonic acid | 68259-12-1 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorononanoic acid | 375-95-1 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorooctadecanoic acid | 16517-11-6 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorooctanesulfonamide | 754-91-6 | < 0.33 Q0 | 0.33 | 1 |
| 14027 | Perfluorooctanesulfonic acid | 1763-23-1 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorooctanoic acid | 335-67-1 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluoropentanesulfonate | 2706-91-4 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluoropentanoic acid | 2706-90-3 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorotetradecanoic acid | 376-06-7 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluorotridecanoic acid | 72629-94-8 | < 0.33 | 0.33 | 1 |
| 14027 | Perfluoroundecanoic acid | 2058-94-8 | < 0.33 | 0.33 | 1 |

The stated QC limits are advisory only until sufficient data points can be obtained to calculate statistical limits.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits as noted on the QC Summary.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits in the method blank and Laboratory Control Sample Duplicate (LCSD) as noted on the QC Summary.

Z=The response for a target analyte(s) in the closing continuing calibration verification standard is outside the QC acceptance limits. Since the response is high indicating increased sensitivity, and the target analyte(s) is not detected in the sample, the data is reported.

The inital weight of the sample was 243.31 grams.

REVISED

**Sample Description:** **Tie-Nylon Tie Wrap Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112178**
**ELLE Group #: 2055933**
**Matrix: Solid**

## Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

## Laboratory Sample Analysis Record

| CAT No. | Analysis Name | Method | Trial# | Batch# | Analysis Date and Time | Analyst | Dilution Factor |
|---|---|---|---|---|---|---|---|
| 14027 | 28 PFAS in Soil | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/04/2019 22:01 | Jason W Knight | 1 |
| 14090 | PFAS Solid Prep | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/01/2019 08:00 | Robert Brown | 1 |

REVISED

**Sample Description:** **Sock-Polyester Geotextile Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112179**
**ELLE Group #: 2055933**
**Matrix: Solid**

| CAT No. | Analysis Name | CAS Number | As Received Result | As Received Limit of Quantitation | Dilution Factor |
|---|---|---|---|---|---|
| **LC/MS/MS Miscellaneous** | **EPA 537 Version 1.1 Modified** | | **ng/g** | **ng/g** | |
| 14027 | 10:2Fluorotelomersulfonic acid | 120226-60-0 | < 0.51 Z | 0.51 | 1 |
| 14027 | 4:2-Fluorotelomersulfonic acid | 757124-72-4 | 3.9 Q0 | 0.51 | 1 |
| 14027 | 6:2-Fluorotelomersulfonic acid | 27619-97-2 | 2,000 | 100 | 100 |
| 14027 | 8:2-Fluorotelomersulfonic acid | 39108-34-4 | < 0.77 | 0.77 | 1 |
| 14027 | NEtFOSAA | 2991-50-6 | < 0.51 | 0.51 | 1 |
| | NEtFOSAA is the acronym for N-ethyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | NMeFOSAA | 2355-31-9 | < 0.51 | 0.51 | 1 |
| | NMeFOSAA is the acronym for N-methyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | Perfluorobutanesulfonic acid | 375-73-5 | < 0.51 | 0.51 | 1 |
| 14027 | Perfluorobutanoic acid | 375-22-4 | < 0.51 | 0.51 | 1 |
| 14027 | Perfluorodecanesulfonic acid | 335-77-3 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorodecanoic acid | 335-76-2 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorododecanesulfonic acid | 79780-39-5 | < 0.51 | 0.51 | 1 |
| 14027 | Perfluorododecanoic acid | 307-55-1 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluoroheptanesulfonic acid | 375-92-8 | 0.18 | 0.15 | 1 |
| 14027 | Perfluoroheptanoic acid | 375-85-9 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorohexadecanoic acid | 67905-19-5 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorohexanesulfonic acid | 355-46-4 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorohexanoic acid | 307-24-4 | 0.33 | 0.15 | 1 |
| 14027 | Perfluorononanesulfonic acid | 68259-12-1 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorononanoic acid | 375-95-1 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorooctadecanoic acid | 16517-11-6 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorooctanesulfonamide | 754-91-6 | < 0.15 Q0 | 0.15 | 1 |
| 14027 | Perfluorooctanesulfonic acid | 1763-23-1 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorooctanoic acid | 335-67-1 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluoropentanesulfonate | 2706-91-4 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluoropentanoic acid | 2706-90-3 | 0.20 | 0.15 | 1 |
| 14027 | Perfluorotetradecanoic acid | 376-06-7 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorotridecanoic acid | 72629-94-8 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluoroundecanoic acid | 2058-94-8 | < 0.15 | 0.15 | 1 |

The stated QC limits are advisory only until sufficient data points can be obtained to calculate statistical limits.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits as noted on the QC Summary.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits in the method blank and Laboratory Control Sample Duplicate (LCSD) as noted on the QC Summary.

Z=The response for a target analyte(s) in the closing continuing calibration verification standard is outside the QC acceptance limits. Since the response is high indicating increased sensitivity, and the target analyte(s) is not detected in the sample, the data is reported.

The inital weight of the sample was 226.40 grams.

REVISED

**Sample Description:** **Sock-Polyester Geotextile Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112179**
**ELLE Group #: 2055933**
**Matrix: Solid**

## Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

## Laboratory Sample Analysis Record

| CAT No. | Analysis Name | Method | Trial# | Batch# | Analysis Date and Time | Analyst | Dilution Factor |
|---|---|---|---|---|---|---|---|
| 14027 | 28 PFAS in Soil | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/04/2019 22:11 | Jason W Knight | 1 |
| 14027 | 28 PFAS in Soil | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/05/2019 20:49 | Jason W Knight | 100 |
| 14090 | PFAS Solid Prep | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/01/2019 08:00 | Robert Brown | 1 |

REVISED

**Sample Description:** **Riser-HDPE Tubing 1/2" Solid PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112180**
**ELLE Group #: 2055933**
**Matrix: Solid**

| CAT No. | Analysis Name | CAS Number | As Received Result | As Received Limit of Quantitation | Dilution Factor |
|---|---|---|---|---|---|
| **LC/MS/MS Miscellaneous** | **EPA 537 Version 1.1 Modified** | | **ng/g** | **ng/g** | |
| 14027 | 10:2Fluorotelomersulfonic acid | 120226-60-0 | < 0.13 Z | 0.13 | 1 |
| 14027 | 4:2-Fluorotelomersulfonic acid | 757124-72-4 | < 0.13 Q0 | 0.13 | 1 |
| 14027 | 6:2-Fluorotelomersulfonic acid | 27619-97-2 | < 0.13 | 0.13 | 1 |
| 14027 | 8:2-Fluorotelomersulfonic acid | 39108-34-4 | < 0.20 | 0.20 | 1 |
| 14027 | NEtFOSAA | 2991-50-6 | < 0.13 | 0.13 | 1 |
| | NEtFOSAA is the acronym for N-ethyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | NMeFOSAA | 2355-31-9 | < 0.13 | 0.13 | 1 |
| | NMeFOSAA is the acronym for N-methyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | Perfluorobutanesulfonic acid | 375-73-5 | < 0.13 | 0.13 | 1 |
| 14027 | Perfluorobutanoic acid | 375-22-4 | < 0.13 | 0.13 | 1 |
| 14027 | Perfluorodecanesulfonic acid | 335-77-3 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorodecanoic acid | 335-76-2 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorododecanesulfonic acid | 79780-39-5 | < 0.13 | 0.13 | 1 |
| 14027 | Perfluorododecanoic acid | 307-55-1 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluoroheptanesulfonic acid | 375-92-8 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluoroheptanoic acid | 375-85-9 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorohexadecanoic acid | 67905-19-5 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorohexanesulfonic acid | 355-46-4 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorohexanoic acid | 307-24-4 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorononanesulfonic acid | 68259-12-1 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorononanoic acid | 375-95-1 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorooctadecanoic acid | 16517-11-6 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorooctanesulfonamide | 754-91-6 | < 0.040 Q0 | 0.040 | 1 |
| 14027 | Perfluorooctanesulfonic acid | 1763-23-1 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorooctanoic acid | 335-67-1 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluoropentanesulfonate | 2706-91-4 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluoropentanoic acid | 2706-90-3 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorotetradecanoic acid | 376-06-7 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluorotridecanoic acid | 72629-94-8 | < 0.040 | 0.040 | 1 |
| 14027 | Perfluoroundecanoic acid | 2058-94-8 | < 0.040 | 0.040 | 1 |

The stated QC limits are advisory only until sufficient data points can be obtained to calculate statistical limits.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits as noted on the QC Summary.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits in the method blank and Laboratory Control Sample Duplicate (LCSD) as noted on the QC Summary.

Z=The response for a target analyte(s) in the closing continuing calibration verification standard is outside the QC acceptance limits. Since the response is high indicating increased sensitivity, and the target analyte(s) is not detected in the sample, the data is reported.

The inital weight of the sample was 241.71 grams.

REVISED

**Sample Description:** **Riser-HDPE Tubing 1/2" Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112180**
**ELLE Group #: 2055933**
**Matrix: Solid**

## Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

## Laboratory Sample Analysis Record

| CAT No. | Analysis Name | Method | Trial# | Batch# | Analysis Date and Time | Analyst | Dilution Factor |
|---|---|---|---|---|---|---|---|
| 14027 | 28 PFAS in Soil | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/04/2019 22:20 | Jason W Knight | 1 |
| 14090 | PFAS Solid Prep | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/01/2019 08:00 | Robert Brown | 1 |

REVISED

**Sample Description:** **Screen-PE Corregated Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112181**
**ELLE Group #: 2055933**
**Matrix: Solid**

| CAT No. | Analysis Name | CAS Number | As Received Result | As Received Limit of Quantitation | Dilution Factor |
|---|---|---|---|---|---|
| **LC/MS/MS Miscellaneous** | **EPA 537 Version 1.1 Modified** | | **ng/g** | **ng/g** | |
| 14027 | 10:2Fluorotelomersulfonic acid | 120226-60-0 | < 0.11 Z | 0.11 | 1 |
| 14027 | 4:2-Fluorotelomersulfonic acid | 757124-72-4 | < 0.11 Q0 | 0.11 | 1 |
| 14027 | 6:2-Fluorotelomersulfonic acid | 27619-97-2 | < 0.11 | 0.11 | 1 |
| 14027 | 8:2-Fluorotelomersulfonic acid | 39108-34-4 | < 0.16 | 0.16 | 1 |
| 14027 | NEtFOSAA | 2991-50-6 | < 0.11 | 0.11 | 1 |
| | NEtFOSAA is the acronym for N-ethyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | NMeFOSAA | 2355-31-9 | < 0.11 | 0.11 | 1 |
| | NMeFOSAA is the acronym for N-methyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | Perfluorobutanesulfonic acid | 375-73-5 | < 0.11 | 0.11 | 1 |
| 14027 | Perfluorobutanoic acid | 375-22-4 | < 0.11 | 0.11 | 1 |
| 14027 | Perfluorodecanesulfonic acid | 335-77-3 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorodecanoic acid | 335-76-2 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorododecanesulfonic acid | 79780-39-5 | < 0.11 | 0.11 | 1 |
| 14027 | Perfluorododecanoic acid | 307-55-1 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluoroheptanesulfonic acid | 375-92-8 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluoroheptanoic acid | 375-85-9 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorohexadecanoic acid | 67905-19-5 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorohexanesulfonic acid | 355-46-4 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorohexanoic acid | 307-24-4 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorononanesulfonic acid | 68259-12-1 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorononanoic acid | 375-95-1 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorooctadecanoic acid | 16517-11-6 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorooctanesulfonamide | 754-91-6 | < 0.033 Q0 | 0.033 | 1 |
| 14027 | Perfluorooctanesulfonic acid | 1763-23-1 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorooctanoic acid | 335-67-1 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluoropentanesulfonate | 2706-91-4 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluoropentanoic acid | 2706-90-3 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorotetradecanoic acid | 376-06-7 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluorotridecanoic acid | 72629-94-8 | < 0.033 | 0.033 | 1 |
| 14027 | Perfluoroundecanoic acid | 2058-94-8 | < 0.033 | 0.033 | 1 |

The stated QC limits are advisory only until sufficient data points can be obtained to calculate statistical limits.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits as noted on the QC Summary.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits in the method blank and Laboratory Control Sample Duplicate (LCSD) as noted on the QC Summary.

Z=The response for a target analyte(s) in the closing continuing calibration verification standard is outside the QC acceptance limits. Since the response is high indicating increased sensitivity, and the target analyte(s) is not detected in the sample, the data is reported.

The inital weight of the sample was 234.26 grams.

REVISED

**Sample Description:** **Screen-PE Corregated Solid PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112181**
**ELLE Group #: 2055933**
**Matrix: Solid**

## Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

## Laboratory Sample Analysis Record

| CAT No. | Analysis Name | Method | Trial# | Batch# | Analysis Date and Time | Analyst | Dilution Factor |
|---|---|---|---|---|---|---|---|
| 14027 | 28 PFAS in Soil | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/04/2019 22:29 | Jason W Knight | 1 |
| 14090 | PFAS Solid Prep | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/01/2019 08:00 | Robert Brown | 1 |

REVISED

**Sample Description:** **Tape-Nylon Pule Mule Tape Printed Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112182**
**ELLE Group #: 2055933**
**Matrix: Solid**

| CAT No. | Analysis Name | CAS Number | As Received Result | As Received Limit of Quantitation | Dilution Factor |
|---|---|---|---|---|---|
| **LC/MS/MS Miscellaneous** | **EPA 537 Version 1.1 Modified** | | **ng/g** | **ng/g** | |
| 14027 | 10:2Fluorotelomersulfonic acid | 120226-60-0 | < 0.51 Z | 0.51 | 1 |
| 14027 | 4:2-Fluorotelomersulfonic acid | 757124-72-4 | 3.0 Q0 | 0.51 | 1 |
| 14027 | 6:2-Fluorotelomersulfonic acid | 27619-97-2 | 1,600 | 100 | 100 |
| 14027 | 8:2-Fluorotelomersulfonic acid | 39108-34-4 | < 0.76 | 0.76 | 1 |
| 14027 | NEtFOSAA | 2991-50-6 | < 0.51 | 0.51 | 1 |
| | NEtFOSAA is the acronym for N-ethyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | NMeFOSAA | 2355-31-9 | < 0.51 | 0.51 | 1 |
| | NMeFOSAA is the acronym for N-methyl perfluorooctanesulfonamidoacetic Acid. | | | | |
| 14027 | Perfluorobutanesulfonic acid | 375-73-5 | < 0.51 | 0.51 | 1 |
| 14027 | Perfluorobutanoic acid | 375-22-4 | < 0.51 | 0.51 | 1 |
| 14027 | Perfluorodecanesulfonic acid | 335-77-3 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorodecanoic acid | 335-76-2 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorododecanesulfonic acid | 79780-39-5 | < 0.51 | 0.51 | 1 |
| 14027 | Perfluorododecanoic acid | 307-55-1 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluoroheptanesulfonic acid | 375-92-8 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluoroheptanoic acid | 375-85-9 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorohexadecanoic acid | 67905-19-5 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorohexanesulfonic acid | 355-46-4 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorohexanoic acid | 307-24-4 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorononanesulfonic acid | 68259-12-1 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorononanoic acid | 375-95-1 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorooctadecanoic acid | 16517-11-6 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorooctanesulfonamide | 754-91-6 | < 0.15 Q0 | 0.15 | 1 |
| 14027 | Perfluorooctanesulfonic acid | 1763-23-1 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorooctanoic acid | 335-67-1 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluoropentanesulfonate | 2706-91-4 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluoropentanoic acid | 2706-90-3 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorotetradecanoic acid | 376-06-7 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluorotridecanoic acid | 72629-94-8 | < 0.15 | 0.15 | 1 |
| 14027 | Perfluoroundecanoic acid | 2058-94-8 | < 0.15 | 0.15 | 1 |

The stated QC limits are advisory only until sufficient data points can be obtained to calculate statistical limits.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits as noted on the QC Summary.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits in the method blank and Laboratory Control Sample Duplicate (LCSD) as noted on the QC Summary.

Z=The response for a target analyte(s) in the closing continuing calibration verification standard is outside the QC acceptance limits. Since the response is high indicating increased sensitivity, and the target analyte(s) is not detected in the sample, the data is reported.

The inital weight of the sample was 231.21 grams.

REVISED

**Sample Description:** **Tape-Nylon Pule Mule Tape Printed Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS Analysis**

Submittal Date/Time: 07/22/2019 15:00
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: SW 1112182**
**ELLE Group #: 2055933**
**Matrix: Solid**

## Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

## Laboratory Sample Analysis Record

| CAT No. | Analysis Name | Method | Trial# | Batch# | Analysis Date and Time | Analyst | Dilution Factor |
|---|---|---|---|---|---|---|---|
| 14027 | 28 PFAS in Soil | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/04/2019 22:38 | Jason W Knight | 1 |
| 14027 | 28 PFAS in Soil | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/05/2019 20:58 | Jason W Knight | 100 |
| 14090 | PFAS Solid Prep | EPA 537 Version 1.1 Modified | 1 | 19214009 | 08/01/2019 08:00 | Robert Brown | 1 |

REVISED

# Quality Control Summary

Client Name: ENRX, Inc. Group Number: 2055933
Reported: 08/09/2019 13:51

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

## Method Blank

| Analysis Name | Result | LOQ |
|---|---|---|
| | ng/g | ng/g |
| Batch number: 19214009 | Sample number(s): 1112177-1112182 | |
| 10:2Fluorotelomersulfonic acid | < 1.0 | 1.0 |
| 4:2-Fluorotelomersulfonic acid | < 1.0 | 1.0 |
| 6:2-Fluorotelomersulfonic acid | < 1.0 | 1.0 |
| 8:2-Fluorotelomersulfonic acid | < 1.5 | 1.5 |
| NEtFOSAA | < 1.0 | 1.0 |
| NMeFOSAA | < 1.0 | 1.0 |
| Perfluorobutanesulfonic acid | < 1.0 | 1.0 |
| Perfluorobutanoic acid | < 1.0 | 1.0 |
| Perfluorodecanesulfonic acid | < 0.30 | 0.30 |
| Perfluorodecanoic acid | < 0.30 | 0.30 |
| Perfluorododecanesulfonic acid | < 1.0 | 1.0 |
| Perfluorododecanoic acid | < 0.30 | 0.30 |
| Perfluoroheptanesulfonic acid | < 0.30 | 0.30 |
| Perfluoroheptanoic acid | < 0.30 | 0.30 |
| Perfluorohexadecanoic acid | < 0.30 | 0.30 |
| Perfluorohexanesulfonic acid | < 0.30 | 0.30 |
| Perfluorohexanoic acid | < 0.30 | 0.30 |
| Perfluorononanesulfonic acid | < 0.30 | 0.30 |
| Perfluorononanoic acid | < 0.30 | 0.30 |
| Perfluorooctadecanoic acid | < 0.30 | 0.30 |
| Perfluorooctanesulfonamide | < 0.30 | 0.30 |
| Perfluorooctanesulfonic acid | < 0.30 | 0.30 |
| Perfluorooctanoic acid | < 0.30 | 0.30 |
| Perfluoropentanesulfonate | < 0.30 | 0.30 |
| Perfluoropentanoic acid | < 0.30 | 0.30 |
| Perfluorotetradecanoic acid | < 0.30 | 0.30 |
| Perfluorotridecanoic acid | < 0.30 | 0.30 |
| Perfluoroundecanoic acid | < 0.30 | 0.30 |

## LCS/LCSD

| Analysis Name | LCS Spike Added ng/g | LCS Conc ng/g | LCSD Spike Added ng/g | LCSD Conc ng/g | LCS %REC | LCSD %REC | LCS/LCSD Limits | RPD | RPD Max |
|---|---|---|---|---|---|---|---|---|---|
| Batch number: 19214009 | Sample number(s): 1112177-1112182 | | | | | | | | |
| 10:2Fluorotelomersulfonic acid | 7.71 | 4.98 | 7.71 | 4.46 | 65 | 58 | 54-150 | 11 | 30 |

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

REVISED

# Quality Control Summary

Client Name: ENRX, Inc.
Reported: 08/09/2019 13:51

Group Number: 2055933

## LCS/LCSD (continued)

| Analysis Name | LCS Spike Added ng/g | LCS Conc ng/g | LCSD Spike Added ng/g | LCSD Conc ng/g | LCS %REC | LCSD %REC | LCS/LCSD Limits | RPD | RPD Max |
|---|---|---|---|---|---|---|---|---|---|
| 4:2-Fluorotelomersulfonic acid | 7.47 | 5.59 | 7.47 | 5.57 | 75* | 75* | 77-143 | 0 | 30 |
| 6:2-Fluorotelomersulfonic acid | 7.58 | 4.99 | 7.58 | 5.22 | 66 | 69 | 58-148 | 4 | 30 |
| 8:2-Fluorotelomersulfonic acid | 7.66 | 6.33 | 7.66 | 6.44 | 83 | 84 | 65-147 | 2 | 30 |
| NEtFOSAA | 2.72 | 1.79 | 2.72 | 1.78 | 66 | 65 | 54-143 | 0 | 30 |
| NMeFOSAA | 2.72 | 2.14 | 2.72 | 1.80 | 79 | 66 | 51-157 | 17 | 30 |
| Perfluorobutanesulfonic acid | 2.41 | 2.18 | 2.41 | 2.13 | 91 | 89 | 71-133 | 3 | 30 |
| Perfluorobutanoic acid | 2.72 | 2.83 | 2.72 | 2.65 | 104 | 97 | 75-148 | 7 | 30 |
| Perfluorodecanesulfonic acid | 2.62 | 2.20 | 2.62 | 2.26 | 84 | 86 | 63-153 | 3 | 30 |
| Perfluorodecanoic acid | 2.72 | 2.45 | 2.72 | 2.41 | 90 | 89 | 69-145 | 1 | 30 |
| Perfluorododecanesulfonic acid | 2.64 | 2.59 | 2.64 | 2.06 | 98 | 78 | 51-137 | 23 | 30 |
| Perfluorododecanoic acid | 2.72 | 2.32 | 2.72 | 2.37 | 85 | 87 | 76-137 | 2 | 30 |
| Perfluoroheptanesulfonic acid | 2.59 | 2.18 | 2.59 | 2.00 | 84 | 77 | 68-135 | 9 | 30 |
| Perfluoroheptanoic acid | 2.72 | 2.37 | 2.72 | 2.50 | 87 | 92 | 76-143 | 5 | 30 |
| Perfluorohexadecanoic acid | 2.72 | 2.31 | 2.72 | 2.41 | 85 | 89 | 63-153 | 4 | 30 |
| Perfluorohexanesulfonic acid | 2.57 | 1.92 | 2.57 | 2.06 | 75 | 80 | 68-132 | 7 | 30 |
| Perfluorohexanoic acid | 2.72 | 2.45 | 2.72 | 2.27 | 90 | 83 | 74-140 | 8 | 30 |
| Perfluorononanesulfonic acid | 2.61 | 2.29 | 2.61 | 2.19 | 88 | 84 | 58-141 | 4 | 30 |
| Perfluorononanoic acid | 2.72 | 2.44 | 2.72 | 2.36 | 90 | 87 | 71-146 | 4 | 30 |
| Perfluorooctadecanoic acid | 2.72 | 2.27 | 2.72 | 2.32 | 84 | 85 | 52-155 | 2 | 30 |
| Perfluorooctanesulfonamide | 2.72 | 1.52 | 2.72 | 1.49 | 56* | 55* | 70-131 | 2 | 30 |
| Perfluorooctanesulfonic acid | 2.60 | 2.10 | 2.60 | 1.92 | 81 | 74 | 69-137 | 9 | 30 |
| Perfluorooctanoic acid | 2.72 | 2.35 | 2.72 | 2.18 | 86 | 80 | 74-146 | 7 | 30 |
| Perfluoropentanesulfonate | 2.55 | 2.32 | 2.55 | 2.18 | 91 | 85 | 67-146 | 6 | 30 |
| Perfluoropentanoic acid | 2.72 | 2.55 | 2.72 | 2.55 | 94 | 94 | 74-142 | 0 | 30 |
| Perfluorotetradecanoic acid | 2.72 | 2.39 | 2.72 | 2.42 | 88 | 89 | 76-138 | 1 | 30 |
| Perfluorotridecanoic acid | 2.72 | 2.45 | 2.72 | 2.26 | 90 | 83 | 62-153 | 8 | 30 |
| Perfluoroundecanoic acid | 2.72 | 2.67 | 2.72 | 2.34 | 98 | 86 | 71-143 | 13 | 30 |

## Labeled Isotope Quality Control

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: 28 PFAS in Soil
Batch number: 19214009

| | 13C4-PFBA | 13C5-PFPeA | 13C3-PFBS | 13C2-4:2-FTS | 13C5-PFHxA | 13C3-PFHxS |
|---|---|---|---|---|---|---|
| 1112177 | 102 | 107 | 115 | 654* | 112 | 116 |
| 1112178 | 102 | 116 | 113 | 133 | 97 | 97 |
| 1112179 | 98 | 111 | 110 | 1171* | 177* | 172* |
| 1112180 | 106 | 115 | 115 | 238* | 103 | 107 |
| 1112181 | 105 | 110 | 115 | 327* | 101 | 109 |
| 1112182 | 104 | 113 | 107 | 628* | 155* | 150* |

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

REVISED

# Quality Control Summary

Client Name: ENRX, Inc. Group Number: 2055933
Reported: 08/09/2019 13:51

## Labeled Isotope Quality Control

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: 28 PFAS in Soil
Batch number: 19214009

| | 13C4-PFBA | 13C5-PFPeA | 13C3-PFBS | 13C2-4:2-FTS | 13C5-PFHxA | 13C3-PFHxS |
|---|---|---|---|---|---|---|
| Blank | 110 | 112 | 109 | 130 | 99 | 105 |
| LCS | 101 | 108 | 102 | 128 | 100 | 102 |
| LCSD | 97 | 99 | 94 | 125 | 95 | 98 |
| Limits: | 32-120 | 26-123 | 22-130 | 10-174 | 22-127 | 30-123 |

| | 13C4-PFHpA | 13C2-6:2-FTS | 13C8-PFOA | 13C8-PFOS | 13C9-PFNA | 13C6-PFDA |
|---|---|---|---|---|---|---|
| 1112177 | 92 | 706* | 105 | 111 | 13* | 110 |
| 1112178 | 93 | 136 | 103 | 98 | 99 | 104 |
| 1112179 | 226* | 610* | 96 | 100 | 146* | 97 |
| 1112180 | 109 | 233* | 114 | 104 | 114 | 107 |
| 1112181 | 108 | 321* | 108 | 110 | 128 | 107 |
| 1112182 | 171* | 376* | 101 | 109 | 133 | 116* |
| Blank | 106 | 144 | 102 | 106 | 111 | 110 |
| LCS | 104 | 142 | 104 | 96 | 105 | 100 |
| LCSD | 95 | 126 | 100 | 99 | 100 | 100 |
| Limits: | 25-128 | 10-194 | 28-119 | 39-119 | 20-144 | 30-115 |

| | 13C2-8:2-FTS | d3-NMeFOSAA | 13C7-PFUnDA | d5-NEtFOSAA | 13C2-PFDoDA | 13C2-PFTeDA |
|---|---|---|---|---|---|---|
| 1112177 | 567* | 174* | 93 | 175* | 77 | 88 |
| 1112178 | 164 | 124 | 109 | 125 | 106 | 91 |
| 1112179 | 387* | 52 | 96 | 178* | 84 | 89 |
| 1112180 | 211* | 117 | 118 | 161* | 120 | 114 |
| 1112181 | 213* | 104 | 96 | 140 | 85 | 92 |
| 1112182 | 407* | 173* | 110 | 183* | 29 | 27 |
| Blank | 149 | 132 | 100 | 126 | 115 | 100 |
| LCS | 148 | 105 | 94 | 111 | 95 | 90 |
| LCSD | 138 | 112 | 96 | 111 | 92 | 84 |
| Limits: | 10-200 | 10-140 | 24-124 | 10-150 | 17-124 | 11-123 |

| | 13C8-PFOSA |
|---|---|
| 1112177 | 86 |
| 1112178 | 124* |
| 1112179 | 52 |
| 1112180 | 99 |
| 1112181 | 85 |
| 1112182 | 101 |
| Blank | 125* |
| LCS | 111 |
| LCSD | 118* |

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-6766 • www.EurofinsUS.com/LancLabsEnv

REVISED

# Quality Control Summary

Client Name: ENRX, Inc. Group Number: 2055933
Reported: 08/09/2019 13:51

## Labeled Isotope Quality Control (continued)

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: 28 PFAS in Soil
Batch number: 19214009

Limits: 16-113

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

# PFOA PFOS Analysis

9-14578
G-2055933
S-1112177-82

1 Sleeve - HDPE 3"
1 Tie - Nylon tie wrap
1 Sock - Polyester geotextile
1 Riser - HDPE Tubing 1/2"
1 Screen - PE Corregated
1 Tape - Nylon pule mule tape printed

Chain of Custody

From Lance Robinson ENRx Inc.

Via UPS Ground

504 7/18/19

# Explanation of Symbols and Abbreviations

*The following defines common symbols and abbreviations used in reporting technical data:*

| | | | |
|---|---|---|---|
| **BMQL** | Below Minimum Quantitation Level | **mL** | milliliter(s) |
| **C** | degrees Celsius | **MPN** | Most Probable Number |
| **cfu** | colony forming units | **N.D.** | non-detect |
| **CP Units** | cobalt-chloroplatinate units | **ng** | nanogram(s) |
| **F** | degrees Fahrenheit | **NTU** | nephelometric turbidity units |
| **g** | gram(s) | **pg/L** | picogram/liter |
| **IU** | International Units | **RL** | Reporting Limit |
| **kg** | kilogram(s) | **TNTC** | Too Numerous To Count |
| **L** | liter(s) | **µg** | microgram(s) |
| **lb.** | pound(s) | **µL** | microliter(s) |
| **m3** | cubic meter(s) | **umhos/cm** | micromhos/cm |
| **meq** | milliequivalents | **MCL** | Maximum Contamination Limit |
| **mg** | milligram(s) | | |

| | |
|---|---|
| **<** | less than |
| **>** | greater than |
| **ppm** | parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas. |
| **ppb** | parts per billion |
| **Dry weight basis** | Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis. |

**Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.**

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

**WARRANTY AND LIMITS OF LIABILITY** - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

eurofins | Lancaster Laboratories Environmental

# Data Qualifiers

| Qualifier | Definition |
|---|---|
| C | Result confirmed by reanalysis |
| D1 | Indicates for dual column analyses that the result is reported from column 1 |
| D2 | Indicates for dual column analyses that the result is reported from column 2 |
| E | Concentration exceeds the calibration range |
| K1 | Initial Calibration Blank is above the QC limit and the sample result is ND |
| K2 | Continuing Calibration Blank is above the QC limit and the sample result is ND |
| K3 | Initial Calibration Verification is above the QC limit and the sample result is ND |
| K4 | Continuing Calibration Verification is above the QC limit and the sample result is ND |
| J (or G, I, X) | Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL) |
| P | Concentration difference between the primary and confirmation column >40%. The lower result is reported. |
| P^ | Concentration difference between the primary and confirmation column > 40%. The higher result is reported. |
| U | Analyte was not detected at the value indicated |
| V | Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference. |
| W | The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L. |
| Z | Laboratory Defined - see analysis report |
| B | Detection in the Blank |
| Q0 | LCS/LCSD Low |
| Q1 | LCS/LCSD High |
| Q2 | MS/MSD Low |
| Q3 | MS/MSD High |
| Q7 | LCS/LCSD RPD |
| Q8 | DUP RPD |
| Q9 | MS/MSD RPD |

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

# Appendix B

eurofins | Lancaster Laboratories Environmental

2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-6766 • www.EurofinsUS.com/LancLabsEnv



# ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

ENRX, Inc.
PO Box 27056
Flower Mound TX 75027

Report Date: September 20, 2019 17:03

**Project: PFOA/PFOS**

Account #: 44646
Group Number: 2063392
PO Number: SK 002
State of Sample Origin: PA

| | | |
|---|---|---|
| Electronic Copy To | ENRX, Inc. | Attn: Stephen Koenigsberg |
| Electronic Copy To | ENRX, Inc. | Attn: Lance Robinson |
| Electronic Copy To | ENRX, Inc. | Attn: Erik Piatt |

Respectfully Submitted,

Marrissa Williams
Project Manager

(717) 556-7246

To view our laboratory's current scopes of accreditation please go to https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/ . Historical copies may be requested through your project manager.



2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-6766 • www.EurofinsUS.com/LancLabsEnv

## SAMPLE INFORMATION

| Client Sample Description | Sample Collection Date/Time | ELLE# |
|---|---|---|
| Sock (Geotextile) Solid | NA | 1147596 |
| Tie Wrap (Nylon) Solid | NA | 1147597 |
| Mule Tape (Flat rope Nylon) Solid | NA | 1147598 |

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

**Sample Description:** **Sock (Geotextile) Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS**

Submittal Date/Time: 09/11/2019 13:10
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: G4 1147596**
**ELLE Group #: 2063392**
**Matrix: Solid**

| CAT No. | Analysis Name | CAS Number | As Received Result | As Received Limit of Quantitation* | As Received Method Detection Limit | Dilution Factor |
|---|---|---|---|---|---|---|
| **LC/MS/MS Miscellaneous** | **EPA 537 Version 1.1 Modified** | | **ng/g** | **ng/g** | **ng/g** | |
| 14027 | 4:2-Fluorotelomersulfonic acid[1] | 757124-72-4 | < 1.7 | 1.7 | 0.50 | 1 |
| 14027 | 6:2-Fluorotelomersulfonic acid[1] | 27619-97-2 | < 1.7 | 1.7 | 0.50 | 1 |
| 14027 | 8:2-Fluorotelomersulfonic acid[1] | 39108-34-4 | < 2.5 | 2.5 | 0.50 | 1 |
| 14027 | NEtFOSAA[1] | 2991-50-6 | < 1.7 | 1.7 | 0.17 | 1 |
| | NEtFOSAA is the acronym for N-ethyl perfluorooctanesulfonamidoacetic Acid. | | | | | |
| 14027 | NMeFOSAA[1] | 2355-31-9 | < 1.7 | 1.7 | 0.17 | 1 |
| | NMeFOSAA is the acronym for N-methyl perfluorooctanesulfonamidoacetic Acid. | | | | | |
| 14027 | Perfluorobutanesulfonic acid[1] | 375-73-5 | < 1.7 | 1.7 | 0.33 | 1 |
| 14027 | Perfluorobutanoic acid[1] | 375-22-4 | < 1.7 | 1.7 | 0.67 | 1 |
| 14027 | Perfluorodecanesulfonic acid[1] | 335-77-3 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluorodecanoic acid[1] | 335-76-2 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluorododecanoic acid[1] | 307-55-1 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluoroheptanesulfonic acid[1] | 375-92-8 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluoroheptanoic acid[1] | 375-85-9 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluorohexanesulfonic acid[1] | 355-46-4 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluorohexanoic acid[1] | 307-24-4 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluorononanesulfonic acid[1] | 68259-12-1 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluorononanoic acid[1] | 375-95-1 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluorooctanesulfonamide[1] | 754-91-6 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluorooctanesulfonic acid[1] | 1763-23-1 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluorooctanoic acid[1] | 335-67-1 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluoropentanesulfonate[1] | 2706-91-4 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluoropentanoic acid[1] | 2706-90-3 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluorotetradecanoic acid[1] | 376-06-7 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluorotridecanoic acid[1] | 72629-94-8 | < 0.50 | 0.50 | 0.17 | 1 |
| 14027 | Perfluoroundecanoic acid[1] | 2058-94-8 | < 0.50 | 0.50 | 0.17 | 1 |

The stated QC limits for this matrix should be considered advisory.

The initial weight of this sample was 236.6 grams.

## Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

[1] = This analyte was not on the laboratory's PA DEP Scope of Accreditation at the time of analysis.

## Laboratory Sample Analysis Record

| CAT No. | Analysis Name | Method | Trial# | Batch# | Analysis Date and Time | Analyst | Dilution Factor |
|---|---|---|---|---|---|---|---|
| 14027 | 28 PFAS | EPA 537 Version 1.1 Modified | 1 | 19260019 | 09/19/2019 18:20 | Jason W Knight | 1 |
| 14090 | PFAS Solid Prep | EPA 537 Version 1.1 Modified | 1 | 19260019 | 09/18/2019 09:15 | Robert Brown | 1 |

*=This limit was used in the evaluation of the final result

**Sample Description:** **Tie Wrap (Nylon) Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS**

Submittal Date/Time: 09/11/2019 13:10
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: G4 1147597**
**ELLE Group #: 2063392**
**Matrix: Solid**

| CAT No. | Analysis Name | CAS Number | As Received Result | As Received Limit of Quantitation* | As Received Method Detection Limit | Dilution Factor |
|---|---|---|---|---|---|---|
| **LC/MS/MS Miscellaneous** | **EPA 537 Version 1.1 Modified** | | **ng/g** | **ng/g** | **ng/g** | |
| 14027 | 4:2-Fluorotelomersulfonic acid[1] | 757124-72-4 | < 0.99 | 0.99 | 0.30 | 1 |
| 14027 | 6:2-Fluorotelomersulfonic acid[1] | 27619-97-2 | < 0.99 | 0.99 | 0.30 | 1 |
| 14027 | 8:2-Fluorotelomersulfonic acid[1] | 39108-34-4 | < 1.5 | 1.5 | 0.30 | 1 |
| 14027 | NEtFOSAA[1] | 2991-50-6 | < 0.99 | 0.99 | 0.099 | 1 |
| | NEtFOSAA is the acronym for N-ethyl perfluorooctanesulfonamidoacetic Acid. | | | | | |
| 14027 | NMeFOSAA[1] | 2355-31-9 | < 0.99 | 0.99 | 0.099 | 1 |
| | NMeFOSAA is the acronym for N-methyl perfluorooctanesulfonamidoacetic Acid. | | | | | |
| 14027 | Perfluorobutanesulfonic acid[1] | 375-73-5 | < 0.99 | 0.99 | 0.20 | 1 |
| 14027 | Perfluorobutanoic acid[1] | 375-22-4 | < 0.99 | 0.99 | 0.40 | 1 |
| 14027 | Perfluorodecanesulfonic acid[1] | 335-77-3 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluorodecanoic acid[1] | 335-76-2 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluorododecanoic acid[1] | 307-55-1 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluoroheptanesulfonic acid[1] | 375-92-8 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluoroheptanoic acid[1] | 375-85-9 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluorohexanesulfonic acid[1] | 355-46-4 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluorohexanoic acid[1] | 307-24-4 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluorononanesulfonic acid[1] | 68259-12-1 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluorononanoic acid[1] | 375-95-1 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluorooctanesulfonamide[1] | 754-91-6 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluorooctanesulfonic acid[1] | 1763-23-1 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluorooctanoic acid[1] | 335-67-1 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluoropentanesulfonate[1] | 2706-91-4 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluoropentanoic acid[1] | 2706-90-3 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluorotetradecanoic acid[1] | 376-06-7 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluorotridecanoic acid[1] | 72629-94-8 | < 0.30 | 0.30 | 0.099 | 1 |
| 14027 | Perfluoroundecanoic acid[1] | 2058-94-8 | < 0.30 | 0.30 | 0.099 | 1 |

The stated QC limits for this matrix should be considered advisory.

The initial weight of this sample was 248.25 grams.

## Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

[1] = This analyte was not on the laboratory's PA DEP Scope of Accreditation at the time of analysis.

## Laboratory Sample Analysis Record

| CAT No. | Analysis Name | Method | Trial# | Batch# | Analysis Date and Time | Analyst | Dilution Factor |
|---|---|---|---|---|---|---|---|
| 14027 | 28 PFAS | EPA 537 Version 1.1 Modified | 1 | 19260019 | 09/19/2019 18:29 | Jason W Knight | 1 |
| 14090 | PFAS Solid Prep | EPA 537 Version 1.1 Modified | 1 | 19260019 | 09/18/2019 09:15 | Robert Brown | 1 |

*=This limit was used in the evaluation of the final result

**Sample Description:** **Mule Tape (Flat rope Nylon) Solid**
**PFOA/PFOS Analysis**

**Project Name:** **PFOA/PFOS**

Submittal Date/Time: 09/11/2019 13:10
Collection Date/Time: n.a.

**ENRX, Inc.**
**ELLE Sample #: G4 1147598**
**ELLE Group #: 2063392**
**Matrix: Solid**

| CAT No. | Analysis Name | CAS Number | As Received Result | As Received Limit of Quantitation* | As Received Method Detection Limit | Dilution Factor |
|---|---|---|---|---|---|---|
| **LC/MS/MS Miscellaneous** | **EPA 537 Version 1.1 Modified** | | **ng/g** | **ng/g** | **ng/g** | |
| 14027 | 4:2-Fluorotelomersulfonic acid[1] | 757124-72-4 | < 2.1 | 2.1 | 0.63 | 1 |
| 14027 | 6:2-Fluorotelomersulfonic acid[1] | 27619-97-2 | < 2.1 | 2.1 | 0.63 | 1 |
| 14027 | 8:2-Fluorotelomersulfonic acid[1] | 39108-34-4 | < 3.1 | 3.1 | 0.63 | 1 |
| 14027 | NEtFOSAA[1] | 2991-50-6 | < 2.1 | 2.1 | 0.21 | 1 |
| | NEtFOSAA is the acronym for N-ethyl perfluorooctanesulfonamidoacetic Acid. | | | | | |
| 14027 | NMeFOSAA[1] | 2355-31-9 | < 2.1 | 2.1 | 0.21 | 1 |
| | NMeFOSAA is the acronym for N-methyl perfluorooctanesulfonamidoacetic Acid. | | | | | |
| 14027 | Perfluorobutanesulfonic acid[1] | 375-73-5 | < 2.1 | 2.1 | 0.42 | 1 |
| 14027 | Perfluorobutanoic acid[1] | 375-22-4 | < 2.1 | 2.1 | 0.83 | 1 |
| 14027 | Perfluorodecanesulfonic acid[1] | 335-77-3 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluorodecanoic acid[1] | 335-76-2 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluorododecanoic acid[1] | 307-55-1 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluoroheptanesulfonic acid[1] | 375-92-8 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluoroheptanoic acid[1] | 375-85-9 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluorohexanesulfonic acid[1] | 355-46-4 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluorohexanoic acid[1] | 307-24-4 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluorononanesulfonic acid[1] | 68259-12-1 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluorononanoic acid[1] | 375-95-1 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluorooctanesulfonamide[1] | 754-91-6 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluorooctanesulfonic acid[1] | 1763-23-1 | 0.77 | 0.63 | 0.21 | 1 |
| 14027 | Perfluorooctanoic acid[1] | 335-67-1 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluoropentanesulfonate[1] | 2706-91-4 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluoropentanoic acid[1] | 2706-90-3 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluorotetradecanoic acid[1] | 376-06-7 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluorotridecanoic acid[1] | 72629-94-8 | < 0.63 | 0.63 | 0.21 | 1 |
| 14027 | Perfluoroundecanoic acid[1] | 2058-94-8 | < 0.63 | 0.63 | 0.21 | 1 |

The stated QC limits for this matrix should be considered advisory.

The initial weight of this sample was 242.61 grams.

## Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

[1] = This analyte was not on the laboratory's PA DEP Scope of Accreditation at the time of analysis.

## Laboratory Sample Analysis Record

| CAT No. | Analysis Name | Method | Trial# | Batch# | Analysis Date and Time | Analyst | Dilution Factor |
|---|---|---|---|---|---|---|---|
| 14027 | 28 PFAS | EPA 537 Version 1.1 Modified | 1 | 19260019 | 09/19/2019 18:38 | Jason W Knight | 1 |
| 14090 | PFAS Solid Prep | EPA 537 Version 1.1 Modified | 1 | 19260019 | 09/18/2019 09:15 | Robert Brown | 1 |

*=This limit was used in the evaluation of the final result

2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-6766 • www.EurofinsUS.com/LancLabsEnv

# Quality Control Summary

Client Name: ENRX, Inc. Group Number: 2063392
Reported: 09/20/2019 17:03

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

## Method Blank

| Analysis Name | Result | LOQ** | MDL |
|---|---|---|---|
| | ng/g | ng/g | ng/g |
| Batch number: 19260019 | Sample number(s): 1147596-1147598 | | |
| 4:2-Fluorotelomersulfonic acid | < 2.0 | 2.0 | 0.60 |
| 6:2-Fluorotelomersulfonic acid | < 2.0 | 2.0 | 0.60 |
| 8:2-Fluorotelomersulfonic acid | < 3.0 | 3.0 | 0.60 |
| NEtFOSAA | < 2.0 | 2.0 | 0.20 |
| NMeFOSAA | < 2.0 | 2.0 | 0.20 |
| Perfluorobutanesulfonic acid | < 2.0 | 2.0 | 0.40 |
| Perfluorobutanoic acid | < 2.0 | 2.0 | 0.80 |
| Perfluorodecanesulfonic acid | < 0.60 | 0.60 | 0.20 |
| Perfluorodecanoic acid | < 0.60 | 0.60 | 0.20 |
| Perfluorododecanoic acid | < 0.60 | 0.60 | 0.20 |
| Perfluoroheptanesulfonic acid | < 0.60 | 0.60 | 0.20 |
| Perfluoroheptanoic acid | < 0.60 | 0.60 | 0.20 |
| Perfluorohexanesulfonic acid | < 0.60 | 0.60 | 0.20 |
| Perfluorohexanoic acid | < 0.60 | 0.60 | 0.20 |
| Perfluorononanesulfonic acid | < 0.60 | 0.60 | 0.20 |
| Perfluorononanoic acid | < 0.60 | 0.60 | 0.20 |
| Perfluorooctanesulfonamide | < 0.60 | 0.60 | 0.20 |
| Perfluorooctanesulfonic acid | < 0.60 | 0.60 | 0.20 |
| Perfluorooctanoic acid | < 0.60 | 0.60 | 0.20 |
| Perfluoropentanesulfonate | < 0.60 | 0.60 | 0.20 |
| Perfluoropentanoic acid | < 0.60 | 0.60 | 0.20 |
| Perfluorotetradecanoic acid | < 0.60 | 0.60 | 0.20 |
| Perfluorotridecanoic acid | < 0.60 | 0.60 | 0.20 |
| Perfluoroundecanoic acid | < 0.60 | 0.60 | 0.20 |

## LCS/LCSD

| Analysis Name | LCS Spike Added ng/g | LCS Conc ng/g | LCSD Spike Added ng/g | LCSD Conc ng/g | LCS %REC | LCSD %REC | LCS/LCSD Limits | RPD | RPD Max |
|---|---|---|---|---|---|---|---|---|---|
| Batch number: 19260019 | Sample number(s): 1147596-1147598 | | | | | | | | |
| 4:2-Fluorotelomersulfonic acid | 7.47 | 6.60 | 7.47 | 6.17 | 88 | 83 | 58-134 | 7 | 30 |
| 6:2-Fluorotelomersulfonic acid | 7.58 | 5.94 | 7.58 | 6.21 | 78 | 82 | 51-144 | 5 | 30 |
| 8:2-Fluorotelomersulfonic acid | 7.66 | 5.94 | 7.66 | 6.30 | 78 | 82 | 54-152 | 6 | 30 |
| NEtFOSAA | 2.72 | 2.21 | 2.72 | 1.69 | 81 | 62 | 51-145 | 27 | 30 |
| NMeFOSAA | 2.72 | 2.28 | 2.72 | 2.09 | 84 | 77 | 55-152 | 9 | 30 |

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-6766 • www.EurofinsUS.com/LancLabsEnv

# Quality Control Summary

Client Name: ENRX, Inc. Group Number: 2063392
Reported: 09/20/2019 17:03

## LCS/LCSD (continued)

| Analysis Name | LCS Spike Added ng/g | LCS Conc ng/g | LCSD Spike Added ng/g | LCSD Conc ng/g | LCS %REC | LCSD %REC | LCS/LCSD Limits | RPD | RPD Max |
|---|---|---|---|---|---|---|---|---|---|
| Perfluorobutanesulfonic acid | 2.41 | 2.16 | 2.41 | 2.17 | 90 | 90 | 63-139 | 0 | 30 |
| Perfluorobutanoic acid | 2.72 | 2.59 | 2.72 | 2.57 | 95 | 94 | 56-188 | 1 | 30 |
| Perfluorodecanesulfonic acid | 2.62 | 2.39 | 2.62 | 2.51 | 91 | 96 | 60-142 | 5 | 30 |
| Perfluorodecanoic acid | 2.72 | 2.64 | 2.72 | 2.51 | 97 | 92 | 65-144 | 5 | 30 |
| Perfluorododecanoic acid | 2.72 | 2.72 | 2.72 | 2.75 | 100 | 101 | 62-150 | 1 | 30 |
| Perfluoroheptanesulfonic acid | 2.59 | 2.35 | 2.59 | 2.47 | 91 | 95 | 67-139 | 5 | 30 |
| Perfluoroheptanoic acid | 2.72 | 2.81 | 2.72 | 2.63 | 103 | 97 | 65-153 | 7 | 30 |
| Perfluorohexanesulfonic acid | 2.57 | 2.31 | 2.57 | 2.32 | 90 | 90 | 59-139 | 1 | 30 |
| Perfluorohexanoic acid | 2.72 | 2.54 | 2.72 | 2.54 | 93 | 93 | 64-149 | 0 | 30 |
| Perfluorononanesulfonic acid | 2.61 | 2.58 | 2.61 | 2.56 | 99 | 98 | 62-145 | 1 | 30 |
| Perfluorononanoic acid | 2.72 | 2.65 | 2.72 | 2.71 | 98 | 99 | 64-151 | 2 | 30 |
| Perfluorooctanesulfonamide | 2.72 | 2.24 | 2.72 | 2.27 | 83 | 83 | 61-133 | 1 | 30 |
| Perfluorooctanesulfonic acid | 2.60 | 2.07 | 2.60 | 2.13 | 79 | 82 | 54-132 | 3 | 30 |
| Perfluorooctanoic acid | 2.72 | 2.59 | 2.72 | 2.33 | 95 | 86 | 65-147 | 11 | 30 |
| Perfluoropentanesulfonate | 2.55 | 2.50 | 2.55 | 2.42 | 98 | 95 | 64-144 | 3 | 30 |
| Perfluoropentanoic acid | 2.72 | 2.60 | 2.72 | 2.69 | 96 | 99 | 71-139 | 3 | 30 |
| Perfluorotetradecanoic acid | 2.72 | 2.59 | 2.72 | 2.80 | 95 | 103 | 66-147 | 8 | 30 |
| Perfluorotridecanoic acid | 2.72 | 2.66 | 2.72 | 2.87 | 98 | 105 | 63-152 | 7 | 30 |
| Perfluoroundecanoic acid | 2.72 | 2.64 | 2.72 | 2.51 | 97 | 92 | 65-146 | 5 | 30 |

## Labeled Isotope Quality Control

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: 28 PFAS
Batch number: 19260019

| | 13C4-PFBA | 13C5-PFPeA | 13C3-PFBS | 13C2-4:2-FTS | 13C5-PFHxA | 13C3-PFHxS |
|---|---|---|---|---|---|---|
| 1147596 | 94 | 94 | 92 | 144* | 98 | 98 |
| 1147597 | 104 | 111 | 110 | 131 | 110 | 112 |
| 1147598 | 92 | 88 | 86 | 132 | 106 | 106 |
| Blank | 99 | 93 | 93 | 112 | 109 | 102 |
| LCS | 100 | 97 | 94 | 101 | 103 | 101 |
| LCSD | 104 | 102 | 102 | 115 | 112 | 106 |
| Limits: | 40-117 | 38-118 | 38-120 | 28-137 | 36-120 | 38-124 |

| | 13C4-PFHpA | 13C2-6:2-FTS | 13C8-PFOA | 13C8-PFOS | 13C9-PFNA | 13C6-PFDA |
|---|---|---|---|---|---|---|
| 1147596 | 98 | 129 | 103 | 107 | 114 | 93 |
| 1147597 | 110 | 120 | 100 | 105 | 109 | 102 |
| 1147598 | 103 | 134 | 104 | 94 | 95 | 91 |
| Blank | 99 | 112 | 98 | 105 | 94 | 103 |

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

# Quality Control Summary

Client Name: ENRX, Inc. Group Number: 2063392
Reported: 09/20/2019 17:03

## Labeled Isotope Quality Control (continued)

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: 28 PFAS
Batch number: 19260019

| | 13C4-PFHpA | 13C2-6:2-FTS | 13C8-PFOA | 13C8-PFOS | 13C9-PFNA | 13C6-PFDA |
|---|---|---|---|---|---|---|
| LCS | 99 | 114 | 96 | 103 | 99 | 105 |
| LCSD | 106 | 119 | 109 | 105 | 104 | 111 |
| Limits: | 39-120 | 25-154 | 44-115 | 45-118 | 39-123 | 43-118 |

| | 13C2-8:2-FTS | d3-NMeFOSAA | 13C7-PFUnDA | d5-NEtFOSAA | 13C2-PFDoDA | 13C2-PFTeDA |
|---|---|---|---|---|---|---|
| 1147596 | 130 | 98 | 92 | 137 | 53 | 93 |
| 1147597 | 123 | 106 | 105 | 133 | 102 | 112 |
| 1147598 | 124 | 108 | 99 | 123 | 89 | 95 |
| Blank | 114 | 106 | 99 | 109 | 98 | 101 |
| LCS | 137 | 116 | 108 | 123 | 117 | 119 |
| LCSD | 134 | 119 | 111 | 130 | 107 | 122 |
| Limits: | 26-155 | 10-152 | 34-124 | 10-156 | 28-126 | 26-125 |

| | 13C8-PFOSA |
|---|---|
| 1147596 | 80 |
| 1147597 | 90 |
| 1147598 | 83 |
| Blank | 88 |
| LCS | 95 |
| LCSD | 97 |
| Limits: | 31-127 |

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

A# 446446 G# 2663392 S# 1147596-98

From ENRx 9/3/19

To Eurofins Chuck Nesland

3 Samples for PFOA/PFOS

24 list

1 Sock (Geotextile)

1 Tie wrap (Nylon)

1 Mule Tape (flat rope Nylon)

Via USPS 9/3/19 1310

# Explanation of Symbols and Abbreviations

*The following defines common symbols and abbreviations used in reporting technical data:*

| | | | |
|---|---|---|---|
| **BMQL** | Below Minimum Quantitation Level | **mL** | milliliter(s) |
| **C** | degrees Celsius | **MPN** | Most Probable Number |
| **cfu** | colony forming units | **N.D.** | non-detect |
| **CP Units** | cobalt-chloroplatinate units | **ng** | nanogram(s) |
| **F** | degrees Fahrenheit | **NTU** | nephelometric turbidity units |
| **g** | gram(s) | **pg/L** | picogram/liter |
| **IU** | International Units | **RL** | Reporting Limit |
| **kg** | kilogram(s) | **TNTC** | Too Numerous To Count |
| **L** | liter(s) | **µg** | microgram(s) |
| **lb.** | pound(s) | **µL** | microliter(s) |
| **m3** | cubic meter(s) | **umhos/cm** | micromhos/cm |
| **meq** | milliequivalents | **MCL** | Maximum Contamination Limit |
| **mg** | milligram(s) | | |

| | |
|---|---|
| **<** | less than |
| **>** | greater than |
| **ppm** | parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas. |
| **ppb** | parts per billion |
| **Dry weight basis** | Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis. |

**Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.**

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

**WARRANTY AND LIMITS OF LIABILITY** - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

eurofins | Lancaster Laboratories Environmental

# Data Qualifiers

| Qualifier | Definition |
|---|---|
| C | Result confirmed by reanalysis |
| D1 | Indicates for dual column analyses that the result is reported from column 1 |
| D2 | Indicates for dual column analyses that the result is reported from column 2 |
| E | Concentration exceeds the calibration range |
| K1 | Initial Calibration Blank is above the QC limit and the sample result is ND |
| K2 | Continuing Calibration Blank is above the QC limit and the sample result is ND |
| K3 | Initial Calibration Verification is above the QC limit and the sample result is ND |
| K4 | Continuing Calibration Verification is above the QC limit and the sample result is ND |
| J (or G, I, X) | Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL) |
| P | Concentration difference between the primary and confirmation column >40%. The lower result is reported. |
| P^ | Concentration difference between the primary and confirmation column > 40%. The higher result is reported. |
| U | Analyte was not detected at the value indicated |
| V | Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference. |
| W | The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L. |
| Z | Laboratory Defined - see analysis report |
| B | Detection in the Blank |
| Q0 | LCS/LCSD Low |
| Q1 | LCS/LCSD High |
| Q2 | MS/MSD Low |
| Q3 | MS/MSD High |
| Q7 | LCS/LCSD RPD |
| Q8 | DUP RPD |
| Q9 | MS/MSD RPD |

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

# Appendix C

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

March 07, 2023

Eric Arenberg
ENRX, Inc.
3218 River Road
Wimauma, FL 33598

RE: Workorder: J2301445 PFAS Testing

Dear Eric Arenberg:

Enclosed are the analytical results for sample(s) received by the laboratory on Saturday January 7, 2023. Results reported herein conform to the most current NELAC standards, where applicable, unless otherwise narrated in the body of the report. The analytical results for the samples contained in this report were submitted for analysis as outlined by the Chain of Custody and results pertain only to these samples.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Jason Gebhardt
jgebhardt@aellab.com



**Certificate of Analysis**

This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## Sample Summary

| Lab ID | Sample ID | Matrix | Method | Date Collected | Date Received | Analytes Reported | Basis |
|---|---|---|---|---|---|---|---|
| J2301445001 | Sock | SO | AEL SOP-041/LCMSMS | 01/06/2023 10:24 | 01/07/2023 08:24 | 24 | Dry |
| J2301445003 | 72hr Soaked Sock | SO | AEL SOP-041/LCMSMS | 01/06/2023 10:24 | 01/07/2023 08:24 | 24 | Dry |
| J2301445004 | Sock Rinsate DI H2O | WA | AEL SOP-041/LCMSMS | 01/06/2023 10:24 | 01/07/2023 08:24 | 24 | NA |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## Workorder Summary

### Batch Comments

**HPLj/1766 - E533 Analysis,Water**

The upper control criterion was exceeded for several surrogates/EIS in Continuing Calibration Verification (CCV) standards for analytical batch HPLj:1766, indicating increased sensitivity, however the associated target analytes passed CCV criteria. The client samples reported in this batch did not contain the associated target analytes in question. Since the apparent problem equates to a potential high bias, the data quality is not affected. No further corrective action was required.

The relative percent difference (RPD) for PFDS between the Laboratory Control Sample (LCS) and the Laboratory Control Sample Duplicate (LCSD) was outside control criteria due to relatively higher spike recovery in 4645748LCSD in comparison with 4645747. Spike recoveries in the LCS and LCSD were within acceptable limits, indicating the analytical batch was in control. No further corrective action was required.

**HPLj/1769 - PFAS Analysis,Soil**

The relative percent difference (RPD) for PFDS, PFNS, 8:2FTS and PFHpA between the Laboratory Control Sample (LCS) and the Laboratory Control Sample Duplicate (LCSD) was outside control criteria due to relatively higher spike recovery in 4648109LCSD in comparison with 4648108LCS, except for PFHpA which was higher in the LCS. Spike recoveries in the LCS and LCSD were within acceptable limits, indicating the analytical batch was in control. No further corrective action was required.

The upper control criterion was exceeded for several surrogates/EIS in Continuing Calibration Verification (CCV) standards for analytical batch HPLj:1769, indicating increased sensitivity, however the associated target analytes were within CCV criteria. The client samples reported in this batch did not contain the analytes in question. Since the apparent problem equates to a potential high bias, the data quality is not affected. No further corrective action was required.



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## Analytical Results Qualifiers

### Parameter Qualifiers

| | |
|---|---|
| U | The compound was analyzed for but not detected. |
| I | The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit. |

### Lab Qualifiers

| | |
|---|---|
| J | DOH Certification #E82574 (FL NELAC) AEL-Jacksonville<br>DOD-ELAP Certification #L21-470 (ISO/IEC 17025:2017) AEL-Jacksonville |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## Analytical Results

**Lab ID:** J2301445001 **Date Collected:** 01/06/2023 10:24 **Matrix:** Soil
**Sample ID:** Sock **Date Received:** 01/07/2023 08:24

| Parameter | Results | Units | PQL | MDL | DF | Prepared | Analyzed | Lab |
|---|---|---|---|---|---|---|---|---|
| **(AEL SOP-041/LCMSMS)** | | | | | | | | |
| 4:2 FTS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| 6:2 FTS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| 8:2 FTS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFBS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFBA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFDA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFDS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFDoA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFHpS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFHpA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFHxS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFHxA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFNA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFOS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFOA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFPeS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFPeA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFUnA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFNS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| FOSA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFTeDA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| PFTrDA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| NEtFOSAA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |
| NMeFOSAA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:26 | J |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## Analytical Results

### Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Lab |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS (S) | ug/Kg | 66 | 51 | 77.90 | 50 - 200 | J^ |
| 13C2-6:2FTS (S) | ug/Kg | 66 | 58 | 88.40 | 50 - 200 | J^ |
| 13C2-8:2FTS (S) | ug/Kg | 66 | 110 | 174 | 50 - 200 | J^ |
| 13C2-PFDOA (S) | ug/Kg | 26 | 21 | 80.90 | 50 - 200 | J^ |
| 13C2-PFTEDA (S) | ug/Kg | 13 | 11 | 80.90 | 50 - 200 | J^ |
| 13C3-HFPO-DA (S) | ug/Kg | 26 | 15 | 58.40 | 50 - 200 | J^ |
| 13C3-PFBS (S) | ug/Kg | 26 | 14 | 54.30 | 50 - 200 | J^ |
| 13C3-PFHXS (S) | ug/Kg | 26 | 15 | 58 | 50 - 200 | J^ |
| 13C4-PFBA (S) | ug/Kg | 26 | 18 | 69.70 | 50 - 200 | J^ |
| 13C4-PFHPA (S) | ug/Kg | 26 | 22 | 83.70 | 50 - 200 | J^ |
| 13C5-PFHXA (S) | ug/Kg | 26 | 16 | 60.50 | 50 - 200 | J^ |
| 13C5-PFPEA (S) | ug/Kg | 26 | 17 | 66.50 | 50 - 200 | J^ |
| 13C6-PFDA (S) | ug/Kg | 26 | 22 | 82.90 | 50 - 200 | J^ |
| 13C7-PFUNA (S) | ug/Kg | 26 | 22 | 83.30 | 50 - 200 | J^ |
| 13C8-FOSA (S) | ug/Kg | 13 | 11 | 82.20 | 50 - 200 | J^ |
| 13C8-PFOA (S) | ug/Kg | 26 | 19 | 73.90 | 50 - 200 | J^ |
| 13C8-PFOS (S) | ug/Kg | 26 | 19 | 71.10 | 50 - 200 | J^ |
| 13C9-PFNA (S) | ug/Kg | 26 | 22 | 82.40 | 50 - 200 | J^ |
| D3-NMEFOSAA (S) | ug/Kg | 13 | 18 | 140 | 50 - 200 | J^ |
| D5-NETFOSAA (S) | ug/Kg | 13 | 19 | 141 | 50 - 200 | J^ |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## Analytical Results

**Lab ID:** J2301445003 **Date Collected:** 01/06/2023 10:24 **Matrix:** Soil
**Sample ID:** 72hr Soaked Sock **Date Received:** 01/07/2023 08:24

| Parameter | Results | Units | PQL | MDL | DF | Prepared | Analyzed | Lab |
|---|---|---|---|---|---|---|---|---|
| **(AEL SOP-041/LCMSMS)** | | | | | | | | |
| 4:2 FTS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| 6:2 FTS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| 8:2 FTS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFBS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFBA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFDA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFDS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFDoA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFHpS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFHpA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFHxS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFHxA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFNA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFOS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFOA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFPeS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFPeA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFUnA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFNS | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| FOSA | **4.5 I** | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFTeDA | **47** | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| PFTrDA | **13** | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| NEtFOSAA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |
| NMeFOSAA | 1.3 U | ug/Kg | 5.3 | 1.3 | 1 | 01/31/2023 14:00 | 02/02/2023 08:56 | J |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## Analytical Results

### Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Lab |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS (S) | ug/Kg | 66 | 50 | 76.20 | 50 - 200 | J^ |
| 13C2-6:2FTS (S) | ug/Kg | 66 | 44 | 66.30 | 50 - 200 | J^ |
| 13C2-8:2FTS (S) | ug/Kg | 66 | 48 | 73.30 | 50 - 200 | J^ |
| 13C2-PFDOA (S) | ug/Kg | 26 | 23 | 88.80 | 50 - 200 | J^ |
| 13C2-PFTEDA (S) | ug/Kg | 13 | 12 | 88 | 50 - 200 | J^ |
| 13C3-HFPO-DA (S) | ug/Kg | 26 | 14 | 54.20 | 50 - 200 | J^ |
| 13C3-PFBS (S) | ug/Kg | 26 | 13 | 50.40 | 50 - 200 | J^ |
| 13C3-PFHXS (S) | ug/Kg | 26 | 16 | 61.60 | 50 - 200 | J^ |
| 13C4-PFBA (S) | ug/Kg | 26 | 17 | 65.60 | 50 - 200 | J^ |
| 13C4-PFHPA (S) | ug/Kg | 26 | 20 | 77.50 | 50 - 200 | J^ |
| 13C5-PFHXA (S) | ug/Kg | 26 | 15 | 56.60 | 50 - 200 | J^ |
| 13C5-PFPEA (S) | ug/Kg | 26 | 16 | 62.60 | 50 - 200 | J^ |
| 13C6-PFDA (S) | ug/Kg | 26 | 20 | 75.30 | 50 - 200 | J^ |
| 13C7-PFUNA (S) | ug/Kg | 26 | 22 | 83 | 50 - 200 | J^ |
| 13C8-FOSA (S) | ug/Kg | 13 | 9.90 | 75 | 50 - 200 | J^ |
| 13C8-PFOA (S) | ug/Kg | 26 | 17 | 66.40 | 50 - 200 | J^ |
| 13C8-PFOS (S) | ug/Kg | 26 | 20 | 77.60 | 50 - 200 | J^ |
| 13C9-PFNA (S) | ug/Kg | 26 | 20 | 75 | 50 - 200 | J^ |
| D3-NMEFOSAA (S) | ug/Kg | 13 | 15 | 111 | 50 - 200 | J^ |
| D5-NETFOSAA (S) | ug/Kg | 13 | 8 | 61 | 50 - 200 | J^ |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## Analytical Results

**Lab ID:** J2301445004 **Date Collected:** 01/06/2023 10:24 **Matrix:** Water
**Sample ID:** Sock Rinsate DI H2O **Date Received:** 01/07/2023 08:24

| Parameter | Results | Units | PQL | MDL | DF | Prepared | Analyzed | Lab |
|---|---|---|---|---|---|---|---|---|
| **(AEL SOP-041/LCMSMS)** | | | | | | | | |
| 4:2 FTS | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| 6:2 FTS | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| 8:2 FTS | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| NEtFOSAA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| NMeFOSAA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFBS | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFBA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFDS | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFDA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFDoA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFHpS | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFHpA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFHxS | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFHxA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFNS | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFNA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| FOSA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFOS | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFOA | **0.97 I** | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFPeS | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFPeA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFTeDA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFTrDA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |
| PFUnA | 0.95 U | ng/L | 3.8 | 0.95 | 1 | 01/31/2023 07:30 | 02/02/2023 07:27 | J |



**Certificate of Analysis**

This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## Analytical Results

### Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Lab |
|---|---|---|---|---|---|---|
| **13C2-4:2FTS (S)** | ng/L | 9.50 | 16 | **168** | 50 - 150 | J |
| **13C2-6:2FTS (S)** | ng/L | 9.50 | 22 | **231** | 50 - 150 | J |
| **13C2-8:2FTS (S)** | ng/L | 9.50 | 23 | **241** | 50 - 150 | J |
| 13C2-PFDOA (S) | ng/L | 3.80 | 3.70 | 97.40 | 50 - 150 | J |
| 13C2-PFTEDA (S) | ng/L | 1.90 | 1.60 | 86.70 | 50 - 150 | J |
| 13C3-PFBS (S) | ng/L | 3.80 | 2.60 | 68.80 | 50 - 150 | J |
| 13C3-PFHXS (S) | ng/L | 3.80 | 3.10 | 80.50 | 50 - 150 | J |
| 13C4-PFBA (S) | ng/L | 3.80 | 3.30 | 86.70 | 50 - 150 | J |
| 13C4-PFHPA (S) | ng/L | 3.80 | 3.60 | 95.30 | 50 - 150 | J |
| 13C5-PFHXA (S) | ng/L | 3.80 | 2.90 | 76.20 | 50 - 150 | J |
| 13C5-PFPEA (S) | ng/L | 3.80 | 3.10 | 81.30 | 50 - 150 | J |
| 13C6-PFDA (S) | ng/L | 3.80 | 4.10 | 107 | 50 - 150 | J |
| 13C7-PFUNA (S) | ng/L | 3.80 | 4.10 | 107 | 50 - 150 | J |
| 13C8-FOSA (S) | ng/L | 1.90 | 1.30 | 71 | 50 - 150 | J |
| 13C8-PFOA (S) | ng/L | 3.80 | 3.50 | 92.20 | 50 - 150 | J |
| 13C8-PFOS (S) | ng/L | 3.80 | 3.50 | 92.80 | 50 - 150 | J |
| 13C9-PFNA (S) | ng/L | 3.80 | 3.50 | 93.10 | 50 - 150 | J |
| **D3-NMEFOSAA (S)** | ng/L | 1.90 | 3 | **158** | 50 - 150 | J |
| **D5-NETFOSAA (S)** | ng/L | 1.90 | 6.60 | **347** | 50 - 150 | J |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## QC Results

**QC Batch:** HPLj/1766
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445002, J2301445004, J2301445005
**Analysis Method:** AEL SOP-041/LCMSMS

**Method Blank(4645746)**

| Parameter | Results | Units | PQL | MDL | Lab |
|---|---|---|---|---|---|
| 4:2 FTS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| 6:2 FTS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| 8:2 FTS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| NMeFOSAA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFBS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFBA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFDS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFDA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFDoA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFHpS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFHpA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFHxS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFHxA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFNS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFNA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| FOSA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFOS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFOA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFPeS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFPeA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFTeDA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFTrDA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFUnA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| NEtFOSAA | 1.0 U | ng/L | 4.0 | 1.0 | J |

### Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Lab |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS (S) | ng/mL | 0.01 | 0.01 | 91.40 | 50 - 150 | J |
| 13C2-6:2FTS (S) | ng/mL | 0.01 | 0.01 | 89.70 | 50 - 150 | J |
| 13C2-8:2FTS (S) | ng/mL | 0.01 | 0.01 | 81.70 | 50 - 150 | J |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

**QC Batch:** HPLj/1766
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445002, J2301445004, J2301445005
**Analysis Method:** AEL SOP-041/LCMSMS

## Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Lab |
|---|---|---|---|---|---|---|
| 13C2-PFDOA (S) | ng/mL | 0.0040 | 0 | 73.20 | 50 - 150 | J |
| 13C2-PFTEDA (S) | ng/mL | 0.0020 | 0 | 66.30 | 50 - 150 | J |
| 13C3-PFBS (S) | ng/mL | 0.0040 | 0 | 92.40 | 50 - 150 | J |
| 13C3-PFHXS (S) | ng/mL | 0.0040 | 0 | 96.10 | 50 - 150 | J |
| 13C4-PFBA (S) | ng/mL | 0.0040 | 0 | 90.80 | 50 - 150 | J |
| 13C4-PFHPA (S) | ng/mL | 0.0040 | 0 | 81.30 | 50 - 150 | J |
| 13C5-PFHXA (S) | ng/mL | 0.0040 | 0 | 94.60 | 50 - 150 | J |
| 13C5-PFPEA (S) | ng/mL | 0.0040 | 0 | 86.70 | 50 - 150 | J |
| 13C6-PFDA (S) | ng/mL | 0.0040 | 0 | 85.80 | 50 - 150 | J |
| 13C7-PFUNA (S) | ng/mL | 0.0040 | 0 | 80.80 | 50 - 150 | J |
| 13C8-FOSA (S) | ng/mL | 0.0020 | 0 | 54.10 | 50 - 150 | J |
| 13C8-PFOA (S) | ng/mL | 0.0040 | 0 | 90.70 | 50 - 150 | J |
| 13C8-PFOS (S) | ng/mL | 0.0040 | 0 | 86.40 | 50 - 150 | J |
| 13C9-PFNA (S) | ng/mL | 0.0040 | 0 | 90.70 | 50 - 150 | J |
| D3-NMEFOSAA (S) | ng/mL | 0.0020 | 0 | 103 | 50 - 150 | J |
| D5-NETFOSAA (S) | ng/mL | 0.0020 | 0 | 83.80 | 50 - 150 | J |

**Method Blank(4645746)**

| Parameter | Results | Units | PQL | MDL | Lab |
|---|---|---|---|---|---|
| 4:2 FTS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| 6:2 FTS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| 8:2 FTS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| NMeFOSAA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFBS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFBA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFDS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFDA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFDoA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFHpS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFHpA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFHxS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFHxA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFNS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFNA | 1.0 U | ng/L | 4.0 | 1.0 | J |



**Certificate of Analysis**

This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

**QC Batch:** HPLj/1766
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445002, J2301445004, J2301445005
**Analysis Method:** AEL SOP-041/LCMSMS

| Parameter | Results | Units | PQL | MDL | Lab |
|---|---|---|---|---|---|
| FOSA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFOS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFOA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFPeS | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFPeA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFTeDA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFTrDA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| PFUnA | 1.0 U | ng/L | 4.0 | 1.0 | J |
| NEtFOSAA | 1.0 U | ng/L | 4.0 | 1.0 | J |

## Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Lab |
|---|---|---|---|---|---|---|
| 13C2-4:2FTS (S) | ng/mL | 0.01 | 0.01 | 91.40 | 50 - 150 | J |
| 13C2-6:2FTS (S) | ng/mL | 0.01 | 0.01 | 89.70 | 50 - 150 | J |
| 13C2-8:2FTS (S) | ng/mL | 0.01 | 0.01 | 81.70 | 50 - 150 | J |
| 13C2-PFDOA (S) | ng/mL | 0.0040 | 0 | 73.20 | 50 - 150 | J |
| 13C2-PFTEDA (S) | ng/mL | 0.0020 | 0 | 66.30 | 50 - 150 | J |
| 13C3-PFBS (S) | ng/mL | 0.0040 | 0 | 92.40 | 50 - 150 | J |
| 13C3-PFHXS (S) | ng/mL | 0.0040 | 0 | 96.10 | 50 - 150 | J |
| 13C4-PFBA (S) | ng/mL | 0.0040 | 0 | 90.80 | 50 - 150 | J |
| 13C4-PFHPA (S) | ng/mL | 0.0040 | 0 | 81.30 | 50 - 150 | J |
| 13C5-PFHXA (S) | ng/mL | 0.0040 | 0 | 94.60 | 50 - 150 | J |
| 13C5-PFPEA (S) | ng/mL | 0.0040 | 0 | 86.70 | 50 - 150 | J |
| 13C6-PFDA (S) | ng/mL | 0.0040 | 0 | 85.80 | 50 - 150 | J |
| 13C7-PFUNA (S) | ng/mL | 0.0040 | 0 | 80.80 | 50 - 150 | J |
| 13C8-FOSA (S) | ng/mL | 0.0020 | 0 | 54.10 | 50 - 150 | J |
| 13C8-PFOA (S) | ng/mL | 0.0040 | 0 | 90.70 | 50 - 150 | J |
| 13C8-PFOS (S) | ng/mL | 0.0040 | 0 | 86.40 | 50 - 150 | J |
| 13C9-PFNA (S) | ng/mL | 0.0040 | 0 | 90.70 | 50 - 150 | J |
| D3-NMEFOSAA (S) | ng/mL | 0.0020 | 0 | 103 | 50 - 150 | J |
| D5-NETFOSAA (S) | ng/mL | 0.0020 | 0 | 83.80 | 50 - 150 | J |

**Mid Lab Control Sample (4645747); Mid Lab Control Sample Dup (4645748)**

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| NEtFOSAA | ng/L | 4 | 4.9 | 124 | 61 - 135 | 4.1 | 101 | 19.70 | 20 | J |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

**QC Batch:** HPLj/1766
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445002, J2301445004, J2301445005
**Analysis Method:** AEL SOP-041/LCMSMS

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| 4:2 FTS | ng/L | 3.70 | 4.4 | 119 | 63 - 143 | 3.8 | 102 | 14.90 | 20 | J |
| 6:2 FTS | ng/L | 3.80 | 3.6 | 93.4 | 64 - 140 | 4 | 104 | 10.80 | 20 | J |
| 8:2 FTS | ng/L | 3.80 | 4.9 | 127 | 67 - 138 | 5.5 | **142** | 11.30 | 20 | J |
| NMeFOSAA | ng/L | 4 | 4.2 | 105 | 65 - 136 | 3.8 | 95.9 | 9 | 20 | J |
| PFBS | ng/L | 3.50 | 3.5 | 99 | 72 - 130 | 4.1 | 117 | 16.60 | 20 | J |
| PFBA | ng/L | 4 | 4.5 | 113 | 73 - 129 | 4.7 | 117 | 3.70 | 20 | J |
| PFDS | ng/L | 3.90 | 3.3 | 86.5 | 53 - 142 | 4.4 | 114 | **27.10** | 20 | J |
| PFDA | ng/L | 4 | 4.2 | 104 | 71 - 129 | 4.8 | 119 | 13 | 20 | J |
| PFDoA | ng/L | 4 | 4.5 | 112 | 72 - 134 | 4.5 | 112 | 0.32 | 20 | J |
| PFHpS | ng/L | 3.80 | 3.5 | 90.6 | 69 - 134 | 3.8 | 98.6 | 8.50 | 20 | J |
| PFHpA | ng/L | 4 | 4.3 | 109 | 72 - 130 | 4.1 | 103 | 4.80 | 20 | J |
| PFHxS | ng/L | 3.70 | 3.7 | 100 | 68 - 131 | 3.4 | 93.8 | 6.30 | 20 | J |
| PFHxA | ng/L | 4 | 4.3 | 109 | 72 - 129 | 4.6 | 116 | 6.50 | 20 | J |
| PFNS | ng/L | 3.80 | 4.1 | 106 | 70 - 130 | 4.2 | 110 | 3 | 20 | J |
| PFNA | ng/L | 4 | 5.2 | 129 | 69 - 130 | 4.7 | 117 | 9.80 | 20 | J |
| FOSA | ng/L | 4 | 3.9 | 98.2 | 67 - 137 | 4.6 | 115 | 15.80 | 20 | J |
| PFOS | ng/L | 3.70 | 3.9 | 106 | 65 - 140 | 4 | 107 | 0.92 | 20 | J |
| PFOA | ng/L | 4 | 3.4 | 84.7 | 71 - 133 | 3.3 | 82.6 | 2.50 | 20 | J |
| PFPeS | ng/L | 3.76 | 3.83 | 102 | 71 - 127 | 3.25 | 86.3 | 16.50 | 20 | J |
| PFPeA | ng/L | 4 | 4 | 101 | 72 - 129 | 4.4 | 111 | 9.30 | 20 | J |
| PFTeDA | ng/L | 4 | 4.1 | 103 | 71 - 132 | 4.3 | 109 | 5.50 | 20 | J |
| PFTrDA | ng/L | 4 | 4.9 | 120 | 65 - 144 | 4.7 | 120 | 3.60 | 20 | J |
| PFUnA | ng/L | 4 | 4.1 | 103 | 69 - 133 | 4.3 | 108 | 4.70 | 20 | J |

## Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS (S) | ng/m | 0.01 | 0.01 | 123 | 50 - 150 | 0.01 | 117 | 5.60 | | J |
| 13C2-6:2FTS (S) | ng/m | 0.01 | 0.01 | 134 | 50 - 150 | 0.01 | 111 | 18.40 | | J |
| 13C2-8:2FTS (S) | ng/m | 0.01 | 0.01 | 99.50 | 50 - 150 | 0.01 | 67.10 | 38.90 | | J |
| 13C2-PFDOA (S) | ng/m | 0.0040 | 0 | 90.50 | 50 - 150 | 0 | 99.80 | 9.80 | | J |
| 13C2-PFTEDA (S) | ng/m | 0.0020 | 0 | 75.10 | 50 - 150 | 0 | 86.90 | 14.60 | | J |
| 13C3-PFBS (S) | ng/m | 0.0040 | 0 | 119 | 50 - 150 | 0 | 110 | 8.10 | | J |
| 13C3-PFHXS (S) | ng/m | 0.0040 | 0 | 117 | 50 - 150 | 0 | 116 | 0.49 | | J |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

**QC Batch:** HPLj/1766
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445002, J2301445004, J2301445005
**Analysis Method:** AEL SOP-041/LCMSMS

## Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| 13C4-PFBA (S) | ng/m | 0.0040 | 0 | 98.60 | 50 - 150 | 0 | 101 | 2.30 | | J |
| 13C4-PFHPA (S) | ng/m | 0.0040 | 0 | 105 | 50 - 150 | 0 | 103 | 2.10 | | J |
| 13C5-PFHXA (S) | ng/m | 0.0040 | 0 | 112 | 50 - 150 | 0 | 104 | 7.70 | | J |
| 13C5-PFPEA (S) | ng/m | 0.0040 | 0 | 101 | 50 - 150 | 0 | 100 | 0.64 | | J |
| 13C6-PFDA (S) | ng/m | 0.0040 | 0 | 103 | 50 - 150 | 0 | 93.60 | 9.50 | | J |
| 13C7-PFUNA (S) | ng/m | 0.0040 | 0 | 103 | 50 - 150 | 0 | 94.80 | 8.50 | | J |
| 13C8-FOSA (S) | ng/m | 0.0020 | 0 | 68.70 | 50 - 150 | 0 | 52.50 | 26.60 | | J |
| 13C8-PFOA (S) | ng/m | 0.0040 | 0 | 104 | 50 - 150 | 0 | 103 | 1.50 | | J |
| 13C8-PFOS (S) | ng/m | 0.0040 | 0 | 121 | 50 - 150 | 0 | 112 | 8.40 | | J |
| 13C9-PFNA (S) | ng/m | 0.0040 | 0 | 97.10 | 50 - 150 | 0 | 101 | 3.70 | | J |
| D3-NMEFOSAA (S) | ng/m | 0.0020 | 0 | 106 | 50 - 150 | 0 | 106 | 0.21 | | J |
| D5-NETFOSAA (S) | ng/m | 0.0020 | 0 | 85.10 | 50 - 150 | 0 | 99.60 | 15.70 | | J |

**Mid Lab Control Sample (4645747); Mid Lab Control Sample Dup (4645748)**

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| NEtFOSAA | ng/L | 4 | 4.9 | 124 | 61 - 135 | 4.1 | 101 | 19.70 | 20 | J |
| 4:2 FTS | ng/L | 3.70 | 4.4 | 119 | 63 - 143 | 3.8 | 102 | 14.90 | 20 | J |
| 6:2 FTS | ng/L | 3.80 | 3.6 | 93.4 | 64 - 140 | 4 | 104 | 10.80 | 20 | J |
| 8:2 FTS | ng/L | 3.80 | 4.9 | 127 | 67 - 138 | 5.5 | **142** | 11.30 | 20 | J |
| NMeFOSAA | ng/L | 4 | 4.2 | 105 | 65 - 136 | 3.8 | 95.9 | 9 | 20 | J |
| PFBS | ng/L | 3.50 | 3.5 | 99 | 72 - 130 | 4.1 | 117 | 16.60 | 20 | J |
| PFBA | ng/L | 4 | 4.5 | 113 | 73 - 129 | 4.7 | 117 | 3.70 | 20 | J |
| PFDS | ng/L | 3.90 | 3.3 | 86.5 | 53 - 142 | 4.4 | 114 | **27.10** | 20 | J |
| PFDA | ng/L | 4 | 4.2 | 104 | 71 - 129 | 4.8 | 119 | 13 | 20 | J |
| PFDoA | ng/L | 4 | 4.5 | 112 | 72 - 134 | 4.5 | 112 | 0.32 | 20 | J |
| PFHpS | ng/L | 3.80 | 3.5 | 90.6 | 69 - 134 | 3.8 | 98.6 | 8.50 | 20 | J |
| PFHpA | ng/L | 4 | 4.3 | 109 | 72 - 130 | 4.1 | 103 | 4.80 | 20 | J |
| PFHxS | ng/L | 3.70 | 3.7 | 100 | 68 - 131 | 3.4 | 93.8 | 6.30 | 20 | J |
| PFHxA | ng/L | 4 | 4.3 | 109 | 72 - 129 | 4.6 | 116 | 6.50 | 20 | J |
| PFNS | ng/L | 3.80 | 4.1 | 106 | 70 - 130 | 4.2 | 110 | 3 | 20 | J |
| PFNA | ng/L | 4 | 5.2 | 129 | 69 - 130 | 4.7 | 117 | 9.80 | 20 | J |
| FOSA | ng/L | 4 | 3.9 | 98.2 | 67 - 137 | 4.6 | 115 | 15.80 | 20 | J |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

**QC Batch:** HPLj/1766
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445002, J2301445004, J2301445005
**Analysis Method:** AEL SOP-041/LCMSMS

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| PFOS | ng/L | 3.70 | 3.9 | 106 | 65 - 140 | 4 | 107 | 0.92 | 20 | J |
| PFOA | ng/L | 4 | 3.4 | 84.7 | 71 - 133 | 3.3 | 82.6 | 2.50 | 20 | J |
| PFPeS | ng/L | 3.76 | 3.83 | 102 | 71 - 127 | 3.25 | 86.3 | 16.50 | 20 | J |
| PFPeA | ng/L | 4 | 4 | 101 | 72 - 129 | 4.4 | 111 | 9.30 | 20 | J |
| PFTeDA | ng/L | 4 | 4.1 | 103 | 71 - 132 | 4.3 | 109 | 5.50 | 20 | J |
| PFTrDA | ng/L | 4 | 4.9 | 120 | 65 - 144 | 4.7 | 120 | 3.60 | 20 | J |
| PFUnA | ng/L | 4 | 4.1 | 103 | 69 - 133 | 4.3 | 108 | 4.70 | 20 | J |

## Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| 13C2-4:2FTS (S) | ng/m | 0.01 | 0.01 | 123 | 50 - 150 | 0.01 | 117 | 5.60 | | J |
| 13C2-6:2FTS (S) | ng/m | 0.01 | 0.01 | 134 | 50 - 150 | 0.01 | 111 | 18.40 | | J |
| 13C2-8:2FTS (S) | ng/m | 0.01 | 0.01 | 99.50 | 50 - 150 | 0.01 | 67.10 | 38.90 | | J |
| 13C2-PFDOA (S) | ng/m | 0.0040 | 0 | 90.50 | 50 - 150 | 0 | 99.80 | 9.80 | | J |
| 13C2-PFTEDA (S) | ng/m | 0.0020 | 0 | 75.10 | 50 - 150 | 0 | 86.90 | 14.60 | | J |
| 13C3-PFBS (S) | ng/m | 0.0040 | 0 | 119 | 50 - 150 | 0 | 110 | 8.10 | | J |
| 13C3-PFHXS (S) | ng/m | 0.0040 | 0 | 117 | 50 - 150 | 0 | 116 | 0.49 | | J |
| 13C4-PFBA (S) | ng/m | 0.0040 | 0 | 98.60 | 50 - 150 | 0 | 101 | 2.30 | | J |
| 13C4-PFHPA (S) | ng/m | 0.0040 | 0 | 105 | 50 - 150 | 0 | 103 | 2.10 | | J |
| 13C5-PFHXA (S) | ng/m | 0.0040 | 0 | 112 | 50 - 150 | 0 | 104 | 7.70 | | J |
| 13C5-PFPEA (S) | ng/m | 0.0040 | 0 | 101 | 50 - 150 | 0 | 100 | 0.64 | | J |
| 13C6-PFDA (S) | ng/m | 0.0040 | 0 | 103 | 50 - 150 | 0 | 93.60 | 9.50 | | J |
| 13C7-PFUNA (S) | ng/m | 0.0040 | 0 | 103 | 50 - 150 | 0 | 94.80 | 8.50 | | J |
| 13C8-FOSA (S) | ng/m | 0.0020 | 0 | 68.70 | 50 - 150 | 0 | 52.50 | 26.60 | | J |
| 13C8-PFOA (S) | ng/m | 0.0040 | 0 | 104 | 50 - 150 | 0 | 103 | 1.50 | | J |
| 13C8-PFOS (S) | ng/m | 0.0040 | 0 | 121 | 50 - 150 | 0 | 112 | 8.40 | | J |
| 13C9-PFNA (S) | ng/m | 0.0040 | 0 | 97.10 | 50 - 150 | 0 | 101 | 3.70 | | J |
| D3-NMEFOSAA (S) | ng/m | 0.0020 | 0 | 106 | 50 - 150 | 0 | 106 | 0.21 | | J |
| D5-NETFOSAA (S) | ng/m | 0.0020 | 0 | 85.10 | 50 - 150 | 0 | 99.60 | 15.70 | | J |

## QC Result Comments

**Mid Lab Control Sample Dup - 4645748 - PFDS**

J3|Lab QC Failure



**Certificate of Analysis**

This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## QC Results

**QC Batch:** HPLj/1769
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445001, J2301445003
**Analysis Method:** AEL SOP-041/LCMSMS

**Method Blank(4648107)**

| Parameter | Results | Units | PQL | MDL | Lab |
|---|---|---|---|---|---|
| 8:2 FTS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| NEtFOSAA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| 4:2 FTS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| 6:2 FTS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFBS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFBA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFDA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFDS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFDoA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFHpS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFHpA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFHxS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFHxA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFNA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFOS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFOA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFPeS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFPeA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFUnA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFNS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| FOSA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFTeDA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFTrDA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| NMeFOSAA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |

### Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Lab |
|---|---|---|---|---|---|---|
| **13C2-4:2FTS (S)** | ng/mL | 6200 | 5.50 | **0.0890** | 50 - 200 | J^ |
| **13C2-6:2FTS (S)** | ng/mL | 6200 | 4.10 | **0.0670** | 50 - 200 | J^ |
| **13C2-8:2FTS (S)** | ng/mL | 6200 | 5.50 | **0.0890** | 50 - 200 | J^ |
| **13C2-PFDOA (S)** | ng/mL | 2500 | 2.10 | **0.0850** | 50 - 200 | J^ |
| **13C2-PFTEDA (S)** | ng/mL | 1200 | 1 | **0.0820** | 50 - 200 | J^ |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

**QC Batch:** HPLj/1769
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445001, J2301445003

**Analysis Method:** AEL SOP-041/LCMSMS

## Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Lab |
|---|---|---|---|---|---|---|
| **13C3-HFPO-DA (S)** | ng/mL | 2500 | 2 | **0.08** | 50 - 200 | J^ |
| **13C3-PFBS (S)** | ng/mL | 2500 | 1.80 | **0.0730** | 50 - 200 | J^ |
| **13C3-PFHXS (S)** | ng/mL | 2500 | 1.80 | **0.0750** | 50 - 200 | J^ |
| **13C4-PFBA (S)** | ng/mL | 2500 | 1.90 | **0.0780** | 50 - 200 | J^ |
| **13C4-PFHPA (S)** | ng/mL | 2500 | 1.90 | **0.0770** | 50 - 200 | J^ |
| **13C5-PFHXA (S)** | ng/mL | 2500 | 1.80 | **0.0710** | 50 - 200 | J^ |
| **13C5-PFPEA (S)** | ng/mL | 2500 | 1.90 | **0.0750** | 50 - 200 | J^ |
| **13C6-PFDA (S)** | ng/mL | 2500 | 1.90 | **0.0770** | 50 - 200 | J^ |
| **13C7-PFUNA (S)** | ng/mL | 2500 | 2 | **0.0820** | 50 - 200 | J^ |
| **13C8-FOSA (S)** | ng/mL | 1200 | 0.94 | **0.0760** | 50 - 200 | J^ |
| **13C8-PFOA (S)** | ng/mL | 2500 | 1.90 | **0.0750** | 50 - 200 | J^ |
| **13C8-PFOS (S)** | ng/mL | 2500 | 1.90 | **0.0790** | 50 - 200 | J^ |
| **13C9-PFNA (S)** | ng/mL | 2500 | 2 | **0.0790** | 50 - 200 | J^ |
| **D3-NMEFOSAA (S)** | ng/mL | 1200 | 1.40 | **0.11** | 50 - 200 | J^ |
| **D5-NETFOSAA (S)** | ng/mL | 1200 | 0.97 | **0.0780** | 50 - 200 | J^ |

**Method Blank(4648107)**

| Parameter | Results | Units | PQL | MDL | Lab |
|---|---|---|---|---|---|
| 8:2 FTS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| NEtFOSAA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| 4:2 FTS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| 6:2 FTS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFBS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFBA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFDA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFDS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFDoA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFHpS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFHpA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFHxS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFHxA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFNA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFOS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFOA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

**QC Batch:** HPLj/1769
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445001, J2301445003

**Analysis Method:** AEL SOP-041/LCMSMS

| Parameter | Results | Units | PQL | MDL | Lab |
|---|---|---|---|---|---|
| PFPeS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFPeA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFUnA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFNS | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| FOSA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFTeDA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| PFTrDA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |
| NMeFOSAA | 0.12 U | ug/Kg | 0.50 | 0.12 | J |

## Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Lab |
|---|---|---|---|---|---|---|
| **13C2-4:2FTS (S)** | ng/mL | 6200 | 5.50 | **0.0890** | 50 - 200 | J^ |
| **13C2-6:2FTS (S)** | ng/mL | 6200 | 4.10 | **0.0670** | 50 - 200 | J^ |
| **13C2-8:2FTS (S)** | ng/mL | 6200 | 5.50 | **0.0890** | 50 - 200 | J^ |
| **13C2-PFDOA (S)** | ng/mL | 2500 | 2.10 | **0.0850** | 50 - 200 | J^ |
| **13C2-PFTEDA (S)** | ng/mL | 1200 | 1 | **0.0820** | 50 - 200 | J^ |
| **13C3-HFPO-DA (S)** | ng/mL | 2500 | 2 | **0.08** | 50 - 200 | J^ |
| **13C3-PFBS (S)** | ng/mL | 2500 | 1.80 | **0.0730** | 50 - 200 | J^ |
| **13C3-PFHXS (S)** | ng/mL | 2500 | 1.80 | **0.0750** | 50 - 200 | J^ |
| **13C4-PFBA (S)** | ng/mL | 2500 | 1.90 | **0.0780** | 50 - 200 | J^ |
| **13C4-PFHPA (S)** | ng/mL | 2500 | 1.90 | **0.0770** | 50 - 200 | J^ |
| **13C5-PFHXA (S)** | ng/mL | 2500 | 1.80 | **0.0710** | 50 - 200 | J^ |
| **13C5-PFPEA (S)** | ng/mL | 2500 | 1.90 | **0.0750** | 50 - 200 | J^ |
| **13C6-PFDA (S)** | ng/mL | 2500 | 1.90 | **0.0770** | 50 - 200 | J^ |
| **13C7-PFUNA (S)** | ng/mL | 2500 | 2 | **0.0820** | 50 - 200 | J^ |
| **13C8-FOSA (S)** | ng/mL | 1200 | 0.94 | **0.0760** | 50 - 200 | J^ |
| **13C8-PFOA (S)** | ng/mL | 2500 | 1.90 | **0.0750** | 50 - 200 | J^ |
| **13C8-PFOS (S)** | ng/mL | 2500 | 1.90 | **0.0790** | 50 - 200 | J^ |
| **13C9-PFNA (S)** | ng/mL | 2500 | 2 | **0.0790** | 50 - 200 | J^ |
| **D3-NMEFOSAA (S)** | ng/mL | 1200 | 1.40 | **0.11** | 50 - 200 | J^ |
| **D5-NETFOSAA (S)** | ng/mL | 1200 | 0.97 | **0.0780** | 50 - 200 | J^ |

**Lab Control Sample (4648108); Lab Control Sample Duplicate (4648109); Parent Lab Sample (J2301445001, J2301445003)**

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | ug/Kg | 2.40 | 2.2 | 89.8 | 65 - 137 | 3.1 | 132 | **35.10** | 20 | J |



**Certificate of Analysis**

This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

**QC Batch:** HPLj/1769
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445001, J2301445003

**Analysis Method:** AEL SOP-041/LCMSMS

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| NEtFOSAA | ug/Kg | 2.50 | 2.4 | 94.9 | 61 - 139 | 2.4 | 98.6 | 0.35 | 20 | J |
| 4:2 FTS | ug/Kg | 2.30 | 2.9 | 122 | 62 - 145 | 2.4 | 104 | 19.20 | 20 | J |
| 6:2 FTS | ug/Kg | 2.40 | 2.5 | 106 | 64 - 140 | 2.2 | 96 | 13.50 | 20 | J |
| PFBS | ug/Kg | 2.20 | 2.5 | 113 | 72 - 128 | 2.3 | 107 | 9.50 | 20 | J |
| PFBA | ug/Kg | 2.50 | 2.6 | 103 | 71 - 135 | 2.4 | 101 | 5.70 | 20 | J |
| PFDA | ug/Kg | 2.50 | 2.6 | 103 | 69 - 133 | 2.6 | 109 | 1.80 | 20 | J |
| PFDS | ug/Kg | 2.40 | 2.2 | 89.4 | 59 - 134 | 2.7 | 117 | **23.20** | 20 | J |
| PFDoA | ug/Kg | 2.50 | 2.6 | 105 | 69 - 135 | 2.6 | 109 | 0.90 | 20 | J |
| PFHpS | ug/Kg | 2.40 | 2.3 | 97.7 | 70 - 132 | 2.2 | 93.9 | 7.40 | 20 | J |
| PFHpA | ug/Kg | 2.50 | 2.7 | 110 | 71 - 131 | 2.2 | 91.8 | **21** | 20 | J |
| PFHxS | ug/Kg | 2.30 | 2.2 | 98.2 | 67 - 130 | 2 | 92.7 | 9.20 | 20 | J |
| PFHxA | ug/Kg | 2.50 | 2.5 | 99.5 | 70 - 132 | 2.5 | 105 | 2.20 | 20 | J |
| PFNA | ug/Kg | 2.50 | 2.7 | 108 | 72 - 129 | 2.6 | 108 | 3.30 | 20 | J |
| PFOS | ug/Kg | 2.30 | 2.2 | 95.4 | 68 - 136 | 2.3 | 104 | 5.50 | 20 | J |
| PFOA | ug/Kg | 2.50 | 2.1 | 86 | 69 - 133 | 1.9 | 76.9 | 14.60 | 20 | J |
| PFPeS | ug/Kg | 2.40 | 2.1 | 90.9 | 73 - 123 | 2 | 86.1 | 8.80 | 20 | J |
| PFPeA | ug/Kg | 2.50 | 2.5 | 102 | 69 - 132 | 2.6 | 109 | 3.50 | 20 | J |
| PFUnA | ug/Kg | 2.50 | 2.1 | 85.9 | 64 - 136 | 2.5 | 102 | 13.40 | 20 | J |
| PFNS | ug/Kg | 2.40 | 2.6 | 108 | 69 - 125 | 3 | **131** | 15.70 | 20 | J |
| FOSA | ug/Kg | 2.50 | 2.4 | 95.9 | 67 - 137 | 2.3 | 95.7 | 3.60 | 20 | J |
| PFTeDA | ug/Kg | 2.50 | 2.3 | 92.3 | 69 - 133 | 2.5 | 104 | 8.20 | 20 | J |
| PFTrDA | ug/Kg | 2.50 | 2.5 | 99 | 66 - 139 | 2.4 | 100 | 2 | 20 | J |
| NMeFOSAA | ug/Kg | 2.50 | 2.3 | 90.5 | 63 - 144 | 2 | 82.6 | 12.50 | 20 | J |

## Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| **13C2-4:2FTS (S)** | ng/m | 6200 | 6.90 | **0.11** | 50 - 200 | 6.70 | 0.11 | 2.70 | | J^ |
| **13C2-6:2FTS (S)** | ng/m | 6200 | 6.10 | **0.0980** | 50 - 200 | 6.70 | 0.11 | 8.10 | | J^ |
| **13C2-8:2FTS (S)** | ng/m | 6200 | 8.90 | **0.14** | 50 - 200 | 7.50 | 0.12 | 17.20 | | J^ |
| **13C2-PFDOA (S)** | ng/m | 2500 | 2.20 | **0.0870** | 50 - 200 | 2.20 | 0.0920 | 1.90 | | J^ |
| **13C2-PFTEDA (S)** | ng/m | 1200 | 1.20 | **0.0950** | 50 - 200 | 1.10 | 0.0920 | 5.90 | | J^ |
| **13C3-HFPO-DA (S)** | ng/m | 2500 | 2.10 | **0.0840** | 50 - 200 | 1.70 | 0.0690 | 23.20 | | J^ |
| **13C3-PFBS (S)** | ng/m | 2500 | 1.80 | **0.0720** | 50 - 200 | 1.90 | 0.0780 | 3.60 | | J^ |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

**QC Batch:** HPLj/1769
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445001, J2301445003

**Analysis Method:** AEL SOP-041/LCMSMS

## Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| **13C3-PFHXS (S)** | ng/m | 2500 | 2 | **0.0780** | 50 - 200 | 2.10 | 0.0870 | 7.40 | | J^ |
| **13C4-PFBA (S)** | ng/m | 2500 | 2 | **0.08** | 50 - 200 | 2 | 0.0850 | 2.20 | | J^ |
| **13C4-PFHPA (S)** | ng/m | 2500 | 2.10 | **0.0830** | 50 - 200 | 2.30 | 0.0960 | 11.40 | | J^ |
| **13C5-PFHXA (S)** | ng/m | 2500 | 2 | **0.0810** | 50 - 200 | 1.90 | 0.0810 | 3.60 | | J^ |
| **13C5-PFPEA (S)** | ng/m | 2500 | 1.90 | **0.0770** | 50 - 200 | 1.90 | 0.0780 | 1.60 | | J^ |
| **13C6-PFDA (S)** | ng/m | 2500 | 2.20 | **0.0870** | 50 - 200 | 1.90 | 0.0810 | 11.10 | | J^ |
| **13C7-PFUNA (S)** | ng/m | 2500 | 2.30 | **0.0920** | 50 - 200 | 2.10 | 0.0870 | 8.30 | | J^ |
| **13C8-FOSA (S)** | ng/m | 1200 | 1.10 | **0.0870** | 50 - 200 | 1 | 0.0870 | 3.80 | | J^ |
| **13C8-PFOA (S)** | ng/m | 2500 | 2.10 | **0.0830** | 50 - 200 | 2.10 | 0.0870 | 1.40 | | J^ |
| **13C8-PFOS (S)** | ng/m | 2500 | 2.20 | **0.0870** | 50 - 200 | 1.90 | 0.08 | 11.30 | | J^ |
| **13C9-PFNA (S)** | ng/m | 2500 | 2.10 | **0.0850** | 50 - 200 | 2.10 | 0.0860 | 2 | | J^ |
| **D3-NMEFOSAA (S)** | ng/m | 1200 | 1.40 | **0.11** | 50 - 200 | 1.50 | 0.12 | 6.50 | | J^ |
| **D5-NETFOSAA (S)** | ng/m | 1200 | 1.40 | **0.11** | 50 - 200 | 1.50 | 0.13 | 12.70 | | J^ |

**Lab Control Sample (4648108); Lab Control Sample Duplicate (4648109); Parent Lab Sample (J2301445001, J2301445003)**

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| 8:2 FTS | ug/Kg | 2.40 | 2.2 | 89.8 | 65 - 137 | 3.1 | 132 | **35.10** | 20 | J |
| NEtFOSAA | ug/Kg | 2.50 | 2.4 | 94.9 | 61 - 139 | 2.4 | 98.6 | 0.35 | 20 | J |
| 4:2 FTS | ug/Kg | 2.30 | 2.9 | 122 | 62 - 145 | 2.4 | 104 | 19.20 | 20 | J |
| 6:2 FTS | ug/Kg | 2.40 | 2.5 | 106 | 64 - 140 | 2.2 | 96 | 13.50 | 20 | J |
| PFBS | ug/Kg | 2.20 | 2.5 | 113 | 72 - 128 | 2.3 | 107 | 9.50 | 20 | J |
| PFBA | ug/Kg | 2.50 | 2.6 | 103 | 71 - 135 | 2.4 | 101 | 5.70 | 20 | J |
| PFDA | ug/Kg | 2.50 | 2.6 | 103 | 69 - 133 | 2.6 | 109 | 1.80 | 20 | J |
| PFDS | ug/Kg | 2.40 | 2.2 | 89.4 | 59 - 134 | 2.7 | 117 | **23.20** | 20 | J |
| PFDoA | ug/Kg | 2.50 | 2.6 | 105 | 69 - 135 | 2.6 | 109 | 0.90 | 20 | J |
| PFHpS | ug/Kg | 2.40 | 2.3 | 97.7 | 70 - 132 | 2.2 | 93.9 | 7.40 | 20 | J |
| PFHpA | ug/Kg | 2.50 | 2.7 | 110 | 71 - 131 | 2.2 | 91.8 | **21** | 20 | J |
| PFHxS | ug/Kg | 2.30 | 2.2 | 98.2 | 67 - 130 | 2 | 92.7 | 9.20 | 20 | J |
| PFHxA | ug/Kg | 2.50 | 2.5 | 99.5 | 70 - 132 | 2.5 | 105 | 2.20 | 20 | J |
| PFNA | ug/Kg | 2.50 | 2.7 | 108 | 72 - 129 | 2.6 | 108 | 3.30 | 20 | J |
| PFOS | ug/Kg | 2.30 | 2.2 | 95.4 | 68 - 136 | 2.3 | 104 | 5.50 | 20 | J |
| PFOA | ug/Kg | 2.50 | 2.1 | 86 | 69 - 133 | 1.9 | 76.9 | 14.60 | 20 | J |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

**QC Batch:** HPLj/1769
**Preparation Method:** AEL SOP-041/LCMSMS
**Associated Lab IDs:** J2301445001, J2301445003

**Analysis Method:** AEL SOP-041/LCMSMS

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| PFPeS | ug/Kg | 2.40 | 2.1 | 90.9 | 73 - 123 | 2 | 86.1 | 8.80 | 20 | J |
| PFPeA | ug/Kg | 2.50 | 2.5 | 102 | 69 - 132 | 2.6 | 109 | 3.50 | 20 | J |
| PFUnA | ug/Kg | 2.50 | 2.1 | 85.9 | 64 - 136 | 2.5 | 102 | 13.40 | 20 | J |
| PFNS | ug/Kg | 2.40 | 2.6 | 108 | 69 - 125 | 3 | **131** | 15.70 | 20 | J |
| FOSA | ug/Kg | 2.50 | 2.4 | 95.9 | 67 - 137 | 2.3 | 95.7 | 3.60 | 20 | J |
| PFTeDA | ug/Kg | 2.50 | 2.3 | 92.3 | 69 - 133 | 2.5 | 104 | 8.20 | 20 | J |
| PFTrDA | ug/Kg | 2.50 | 2.5 | 99 | 66 - 139 | 2.4 | 100 | 2 | 20 | J |
| NMeFOSAA | ug/Kg | 2.50 | 2.3 | 90.5 | 63 - 144 | 2 | 82.6 | 12.50 | 20 | J |

## Surrogates

| Parameter | Units | Spiked Amount | Spike Result | Spike Recovery | Control Limits | Dup Result | Dup Recovery | RPD | RPD Limit | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| **13C2-4:2FTS (S)** | ng/m | 6200 | 6.90 | **0.11** | 50 - 200 | 6.70 | 0.11 | 2.70 | | J^ |
| **13C2-6:2FTS (S)** | ng/m | 6200 | 6.10 | **0.0980** | 50 - 200 | 6.70 | 0.11 | 8.10 | | J^ |
| **13C2-8:2FTS (S)** | ng/m | 6200 | 8.90 | **0.14** | 50 - 200 | 7.50 | 0.12 | 17.20 | | J^ |
| **13C2-PFDOA (S)** | ng/m | 2500 | 2.20 | **0.0870** | 50 - 200 | 2.20 | 0.0920 | 1.90 | | J^ |
| **13C2-PFTEDA (S)** | ng/m | 1200 | 1.20 | **0.0950** | 50 - 200 | 1.10 | 0.0920 | 5.90 | | J^ |
| **13C3-HFPO-DA (S)** | ng/m | 2500 | 2.10 | **0.0840** | 50 - 200 | 1.70 | 0.0690 | 23.20 | | J^ |
| **13C3-PFBS (S)** | ng/m | 2500 | 1.80 | **0.0720** | 50 - 200 | 1.90 | 0.0780 | 3.60 | | J^ |
| **13C3-PFHXS (S)** | ng/m | 2500 | 2 | **0.0780** | 50 - 200 | 2.10 | 0.0870 | 7.40 | | J^ |
| **13C4-PFBA (S)** | ng/m | 2500 | 2 | **0.08** | 50 - 200 | 2 | 0.0850 | 2.20 | | J^ |
| **13C4-PFHPA (S)** | ng/m | 2500 | 2.10 | **0.0830** | 50 - 200 | 2.30 | 0.0960 | 11.40 | | J^ |
| **13C5-PFHXA (S)** | ng/m | 2500 | 2 | **0.0810** | 50 - 200 | 1.90 | 0.0810 | 3.60 | | J^ |
| **13C5-PFPEA (S)** | ng/m | 2500 | 1.90 | **0.0770** | 50 - 200 | 1.90 | 0.0780 | 1.60 | | J^ |
| **13C6-PFDA (S)** | ng/m | 2500 | 2.20 | **0.0870** | 50 - 200 | 1.90 | 0.0810 | 11.10 | | J^ |
| **13C7-PFUNA (S)** | ng/m | 2500 | 2.30 | **0.0920** | 50 - 200 | 2.10 | 0.0870 | 8.30 | | J^ |
| **13C8-FOSA (S)** | ng/m | 1200 | 1.10 | **0.0870** | 50 - 200 | 1 | 0.0870 | 3.80 | | J^ |
| **13C8-PFOA (S)** | ng/m | 2500 | 2.10 | **0.0830** | 50 - 200 | 2.10 | 0.0870 | 1.40 | | J^ |
| **13C8-PFOS (S)** | ng/m | 2500 | 2.20 | **0.0870** | 50 - 200 | 1.90 | 0.08 | 11.30 | | J^ |
| **13C9-PFNA (S)** | ng/m | 2500 | 2.10 | **0.0850** | 50 - 200 | 2.10 | 0.0860 | 2 | | J^ |
| **D3-NMEFOSAA (S)** | ng/m | 1200 | 1.40 | **0.11** | 50 - 200 | 1.50 | 0.12 | 6.50 | | J^ |
| **D5-NETFOSAA (S)** | ng/m | 1200 | 1.40 | **0.11** | 50 - 200 | 1.50 | 0.13 | 12.70 | | J^ |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## QC Result Comments

**Lab Control Sample Duplicate - 4648109 - PFDS**

J3|Lab QC Failure

**Lab Control Sample Duplicate - 4648109 - PFHpA**

J3|Lab QC Failure

**Lab Control Sample Duplicate - 4648109 - PFNS**

J3|Lab QC Failure



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

POWERED BY HORIZON v.13.1.0

NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)

## QC Cross Reference

| Lab ID | Sample ID | Prep Batch | Prep Method |
|---|---|---|---|
| **HPLj/1766 - AEL SOP-041/LCMSMS** | | | |
| J2301445004 | Sock Rinsate DI H2O | EXTj/5647 | AEL SOP-041/LCMSMS |
| **HPLj/1769 - AEL SOP-041/LCMSMS** | | | |
| J2301445001 | Sock | EXTj/5667 | AEL SOP-041/LCMSMS |
| J2301445003 | 72hr Soaked Sock | EXTj/5667 | AEL SOP-041/LCMSMS |



**Certificate of Analysis**
This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

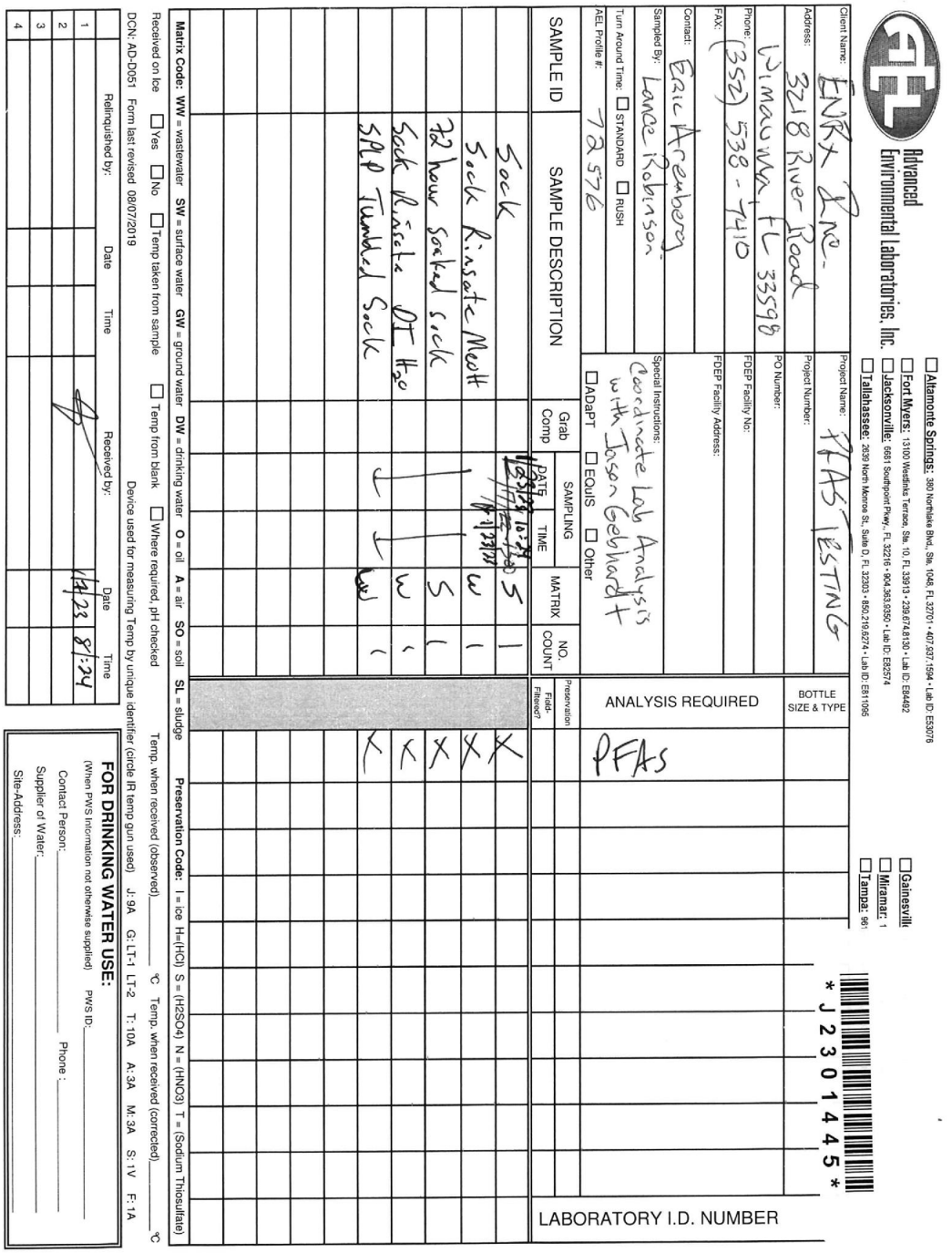


NELAP Accredited E82574

Advanced Environmental Laboratories, Inc
6681 Southpoint Pkwy Jacksonville, FL 32216
Payments: P.O. Box 551580 Jacksonville, FL 32255-1580
Phone: (904) 363-9350
Fax: (904) 363-9354

**FINAL**

**Workorder:** PFAS Testing (J2301445)



Advanced Environmental Laboratories, Inc.

Altamonte Springs: 380 Northlake Blvd., Ste. 1048, FL 32701 • 407.937.1594 • Lab ID: E83076
Fort Myers: 13100 Westlinks Terrace, Ste. 10, FL 33913 • 239.674.8130 • Lab ID: E84492
Jacksonville: 6681 Southpoint Pkwy., FL 32216 • 904.363.9350 • Lab ID: E82574
Tallahassee: 2639 North Monroe St., Suite D, FL 32303 • 850.219.8274 • Lab ID: E81056
Gainesville
Miramar:
Tampa:

Client Name: ENRX Inc-
Address: 3218 River Road
Wimauma FL 33598
Phone: (352) 538-7410
FAX:
Contact: Eric Arceneaux
Sampled By: Lance Robinson
Turn Around Time: ☐ STANDARD ☐ RUSH
AEL Profile #: 72576

Project Name: PFAS TESTING
Project Number:
PO Number:
FDEP Facility No:
FDEP Facility Address:
Special Instructions: Coordinate Lab Analysis with Jason Gebhardt
☐ ADaPT ☐ EQuIS ☐ Other

*J2301445*

| SAMPLE ID | SAMPLE DESCRIPTION | Grab Comp | SAMPLING DATE | SAMPLING TIME | MATRIX | NO. COUNT | Preservation Field-Filtered? | ANALYSIS REQUIRED | BOTTLE SIZE & TYPE |
|---|---|---|---|---|---|---|---|---|---|
| | Sock | | 1/19/23 | 10:27 | W | 1 | | PFAS | |
| | Sock Rinsate Mesh | | 1/19/23 | 10:30 | W | 1 | | | |
| | 72 hour Soaked sock | | | | S | 1 | | | |
| | Sock Rinsate DI H2O | | | | W | 1 | | | |
| | SAP Tumbled Sock | | | | S | 1 | | | |

LABORATORY I.D. NUMBER

Matrix Code: WW = wastewater SW = surface water GW = ground water DW = drinking water O = oil A = air SO = soil SL = sludge

Preservation Code: I = ice H=(HCl) S = (H2SO4) N = (HNO3) T = (Sodium Thiosulfate)

Received on Ice ☐ Yes ☐ No ☐ Temp taken from sample ☐ Temp from blank ☐ Where required, pH checked

Temp. when received (observed)_____ °C Temp. when received (corrected)_____ °C

DCN: AD-D051 Form last revised 08/07/2019

Device used for measuring Temp by unique identifier (circle IR temp gun used) J: 9A G: LT-1 LT-2 T: 10A A: 3A M: 3A S: 1V F: 1A

| | Relinquished by: | Date | Time | Received by: | Date | Time |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | 1/19/23 | 8:24 |
| 3 | | | | | | |
| 4 | | | | | | |

**FOR DRINKING WATER USE:**
(When PWS information not otherwise supplied) PWS ID:_____
Contact Person:_____ Phone:_____
Supplier of Water:_____
Site Address:_____



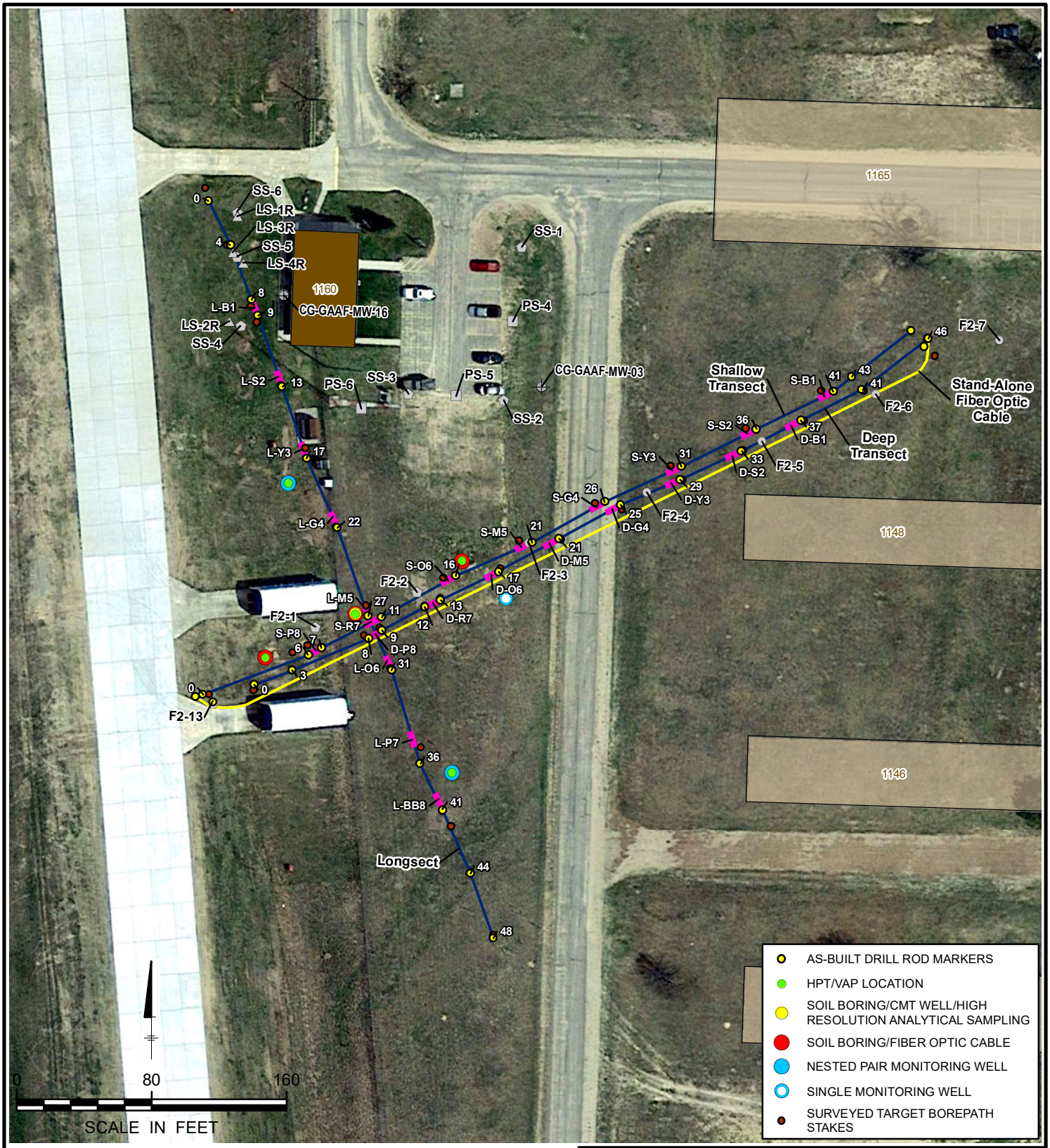
**Certificate of Analysis**

This report shall not be reproduced, except in full,
without the written consent of Advanced Environmental Laboratories, Inc.

NELAP Accredited E82574

POWERED BY HORIZON v.13.1.0

# APPENDIX H VWS AS-BUILT FIGURES




LEGEND

- EXISTING BUILDING
- PLANNED BUILDING

**COMPLETED LOCATIONS**

- HPT AND VAP
- VAP AND SOIL
- HPT, VAP AND SOIL
- LYSIMETER LOCATION
- MONITORING WELL

- SCREEN LOCATIONS
- AS-BUILT VERTEBRAE WELL
- STAND-ALONE FIBER OPTIC CABLE

ESTCP

# AS-BUILT LAYOUT MAP - VERTEBRAE WELLS

ARCADIS Design & Consultancy for natural and built assets

FIGURE H-1

CITY: SAN FRANCISCO DIV/GROUP: ENV/IM DB: kkelley LD: PIC: PM: TM:
PROJECT: PATH: T:_ENV\Camp_Grayling\Mobile Lab PFAS\MXDs\Map_April2021\Fig_4_AsBuilt_Layout_Map_Vertebrae_Wells_v1.mxd DATE: 4/14/2022 10:29:26 AM




LEGEND

- EXISTING BUILDING
- PLANNED BUILDING
- CMT MULTI LEVEL WELL
- MONITORING WELL
- 2021 VERTICAL CHARACTERIZATION

**COMPLETED LOCATIONS**

- 2019 VERTICAL CHARACTERIZATION
- MONITORING WELL
- SCREEN LOCATIONS
- AS-BUILT VERTEBRAE WELL
- STAND-ALONE FIBER OPTIC CABLE

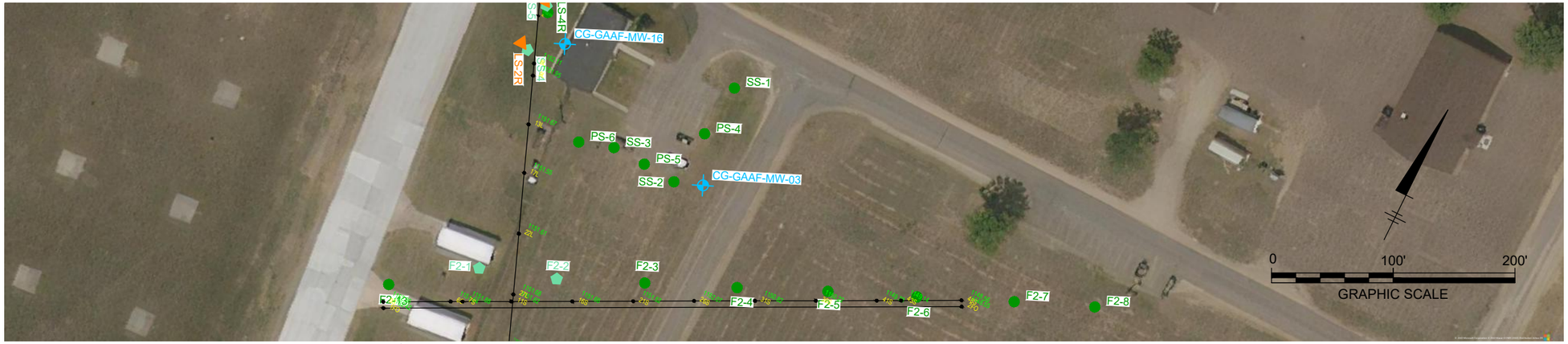
ESTCP

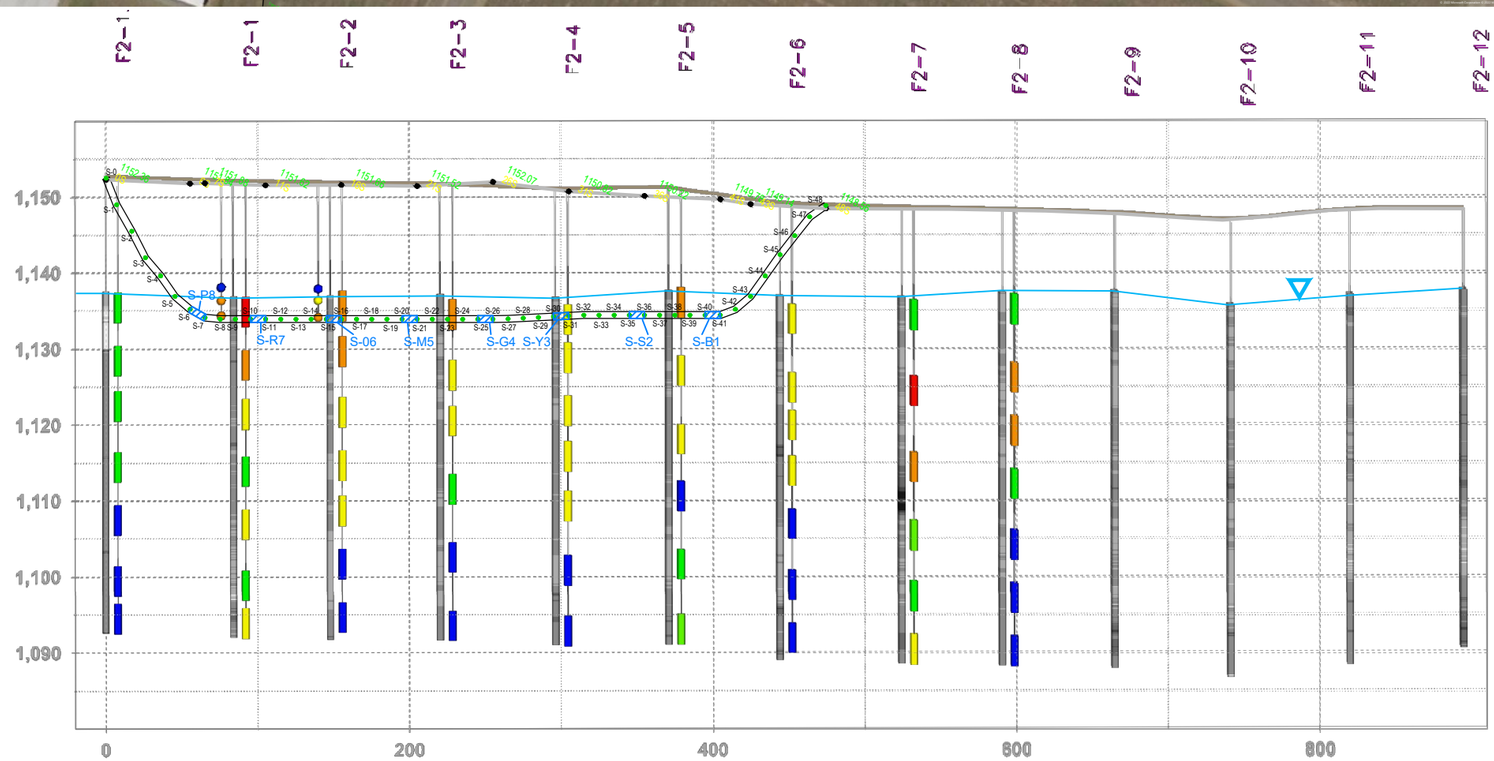
# AS-BUILT LAYOUT MAP - VERTEBRAE WELLS AND VERTICAL CHARACTERIZATION

ARCADIS Design & Consultancy for natural and built assets

FIGURE H-2

CITY: SAN FRANCISCO DIV/GROUP: ENV/IM DB: kkelley LD: PIC: PM: TM:
PROJECT: PATH: T:_ENV\Camp_Grayling\Mobile Lab PFAS\MXDs\Map_April2021\Fig_4B_AsBuilt_Layout_Map_Vertebrae_Wells_Vertical_Characterization.mxd DATE: 6/16/2022 12:45:05 PM




**LEGEND:**

- VERTEBRAE WELL CASING
- S-06 VERTEBRAE WELL SCREEN AND SCREEN ID
- SURVEYED REFERENCE POINT
- HPT AND VAP LOCATION
- HPT, VAP AND SOIL LOCATION
- LYSIMETER LOCATION
- MONITORING WELL LOCATION

TOTAL PFOS ANALYTICAL

- >100,000
- >10,000 - 100,000
- >1,000 - 10,000
- >100 - 1,000
- >40 - 100
- NON DETECT - 40

EST. HYDRAULIC CONDUCTIVITY (ft/day)

- >125 – 150
- >100 – 125
- >75 – 100
- >50 – 75
- >25 – 50
- >2.5 – 25
- >0.1 – 2.5
- ≥0.1

ESTIMATED GROUNDWATER LEVEL DURING HPT LOGGING

0 20' 40'
VERTICAL SCALE

0 100' 200'
HORIZONTAL SCALE

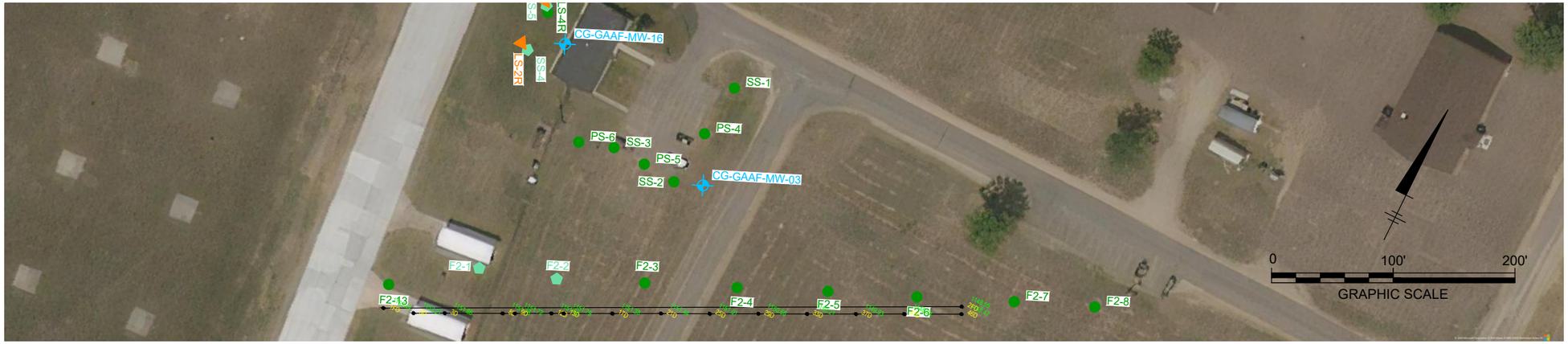
VERTEBRAE-GRAYLING ARMY AIRFIELD-
GRAYLING, MICHIGAN
**ESTCP FINAL REPORT**

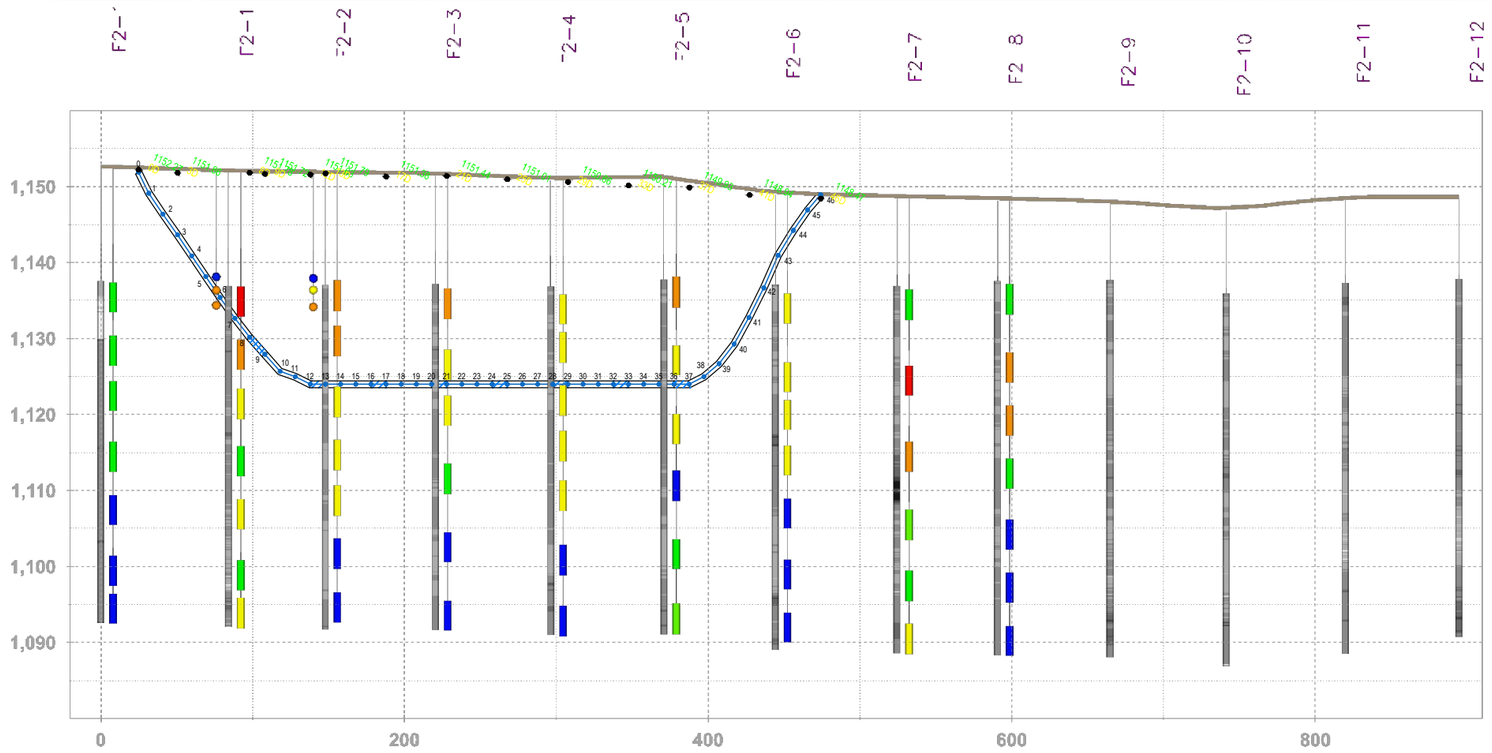
# VERTEBRAE CROSS SECTION SHALLOW TRANSECT

ARCADIS

FIGURE
**G-3**

DIV/GROUP:IMDV DB:G.STOWELL LYR:ON=*;OFF=*REF* ACADVER: 24.2S (LMS TECH) PAGESETUP: TAP PDF PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 4/24/2024 1:44 PM BY: SMITH, ROBERT
C:\Users\bsmith\DOCACCDocs\Arcadis ACC US\AUS-99999999-ESTCP_ARMY AIRFIELD_GRAYLING_MI\Project Files\10_WIP\10T_ARC_ENV\2024\01-DWG\GEN CROSS SECTION.dwg LAYOUT: SHALLOW SAVED: 4/24/2024 1:15 PM




**LEGEND:**

- VERTEBRAE WELL CASING
- VERTEBRAE WELL SCREEN
- HPT AND VAP LOCATION
- HPT, VAP AND SOIL LOCATION
- LYSIMETER LOCATION
- MONITORING WELL LOCATION
- SURVEYED REFERENCE POINT

TOTAL PFOS ANALYTICAL

- >100,000
- >10,000 - 100,000
- >1,000 - 10,000
- >100 - 1,000
- >40 - 100
- NON DETECT - 40

EST. HYDRAULIC CONDUCTIVITY (ft/day)

- >125 – 150
- >100 – 125
- >75 – 100
- >50 – 75
- >25 – 50
- >2.5 – 25
- >0.1 – 2.5
- ≥0.1

ESTIMATED GROUNDWATER LEVEL DURING HPT LOGGING

0 20' 40'
VERTICAL SCALE

0 100' 200'
HORIZONTAL SCALE

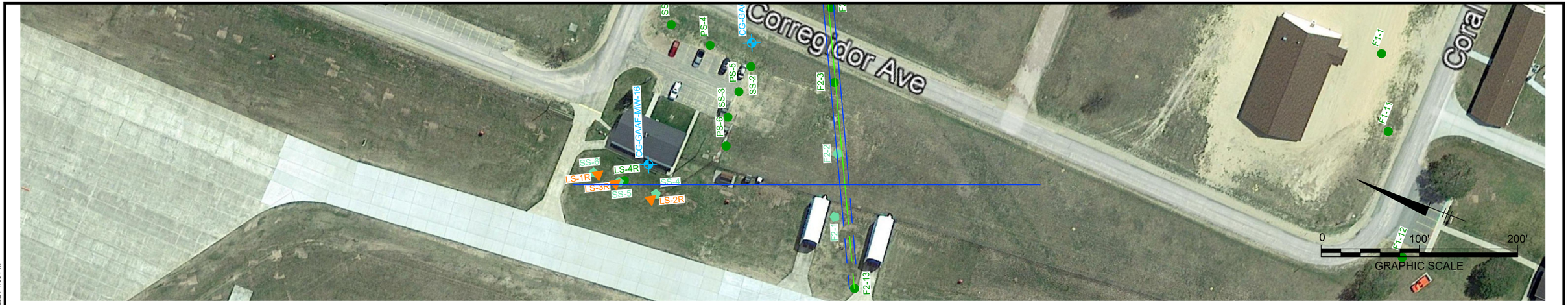
VERTEBRAE-GRAYLING ARMY AIRFIELD-
GRAYLING, MICHIGAN
**ESTCP FINAL REPORT**

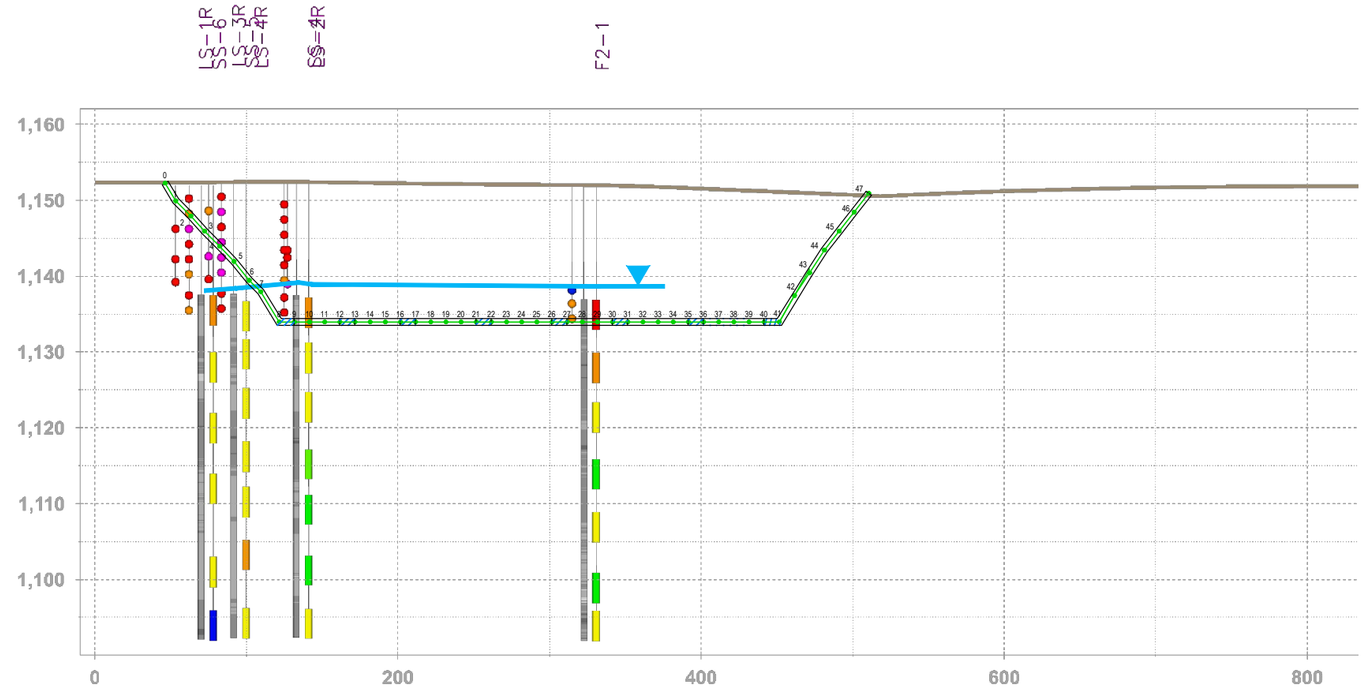
# VERTEBRAE CROSS SECTION DEEP TRANSECT

ARCADIS

FIGURE
**G-4**

DIV/GROUP:IMDV DB:G.STOWELL LYR:ON=*;OFF=*REF* ACADVER: 24.2S (LMS TECH) PAGESETUP: TAP PDF PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 4/24/2024 1:41 PM BY: SMITH, ROBERT
C:\Users\bsmith\DOCACCDocs\Arcadis ACC US\AUS-99999999-ESTCP_ARMY AIRFIELD_GRAYLING_MI\Project Files\10_WIP\10T_ARC_ENV\2024\01-DWG\GEN CROSS SECTION.dwg LAYOUT: DEEP SAVED: 4/24/2024 1:15 PM




**LEGEND:**

- VERTEBRAE WELL CASING
- VERTEBRAE WELL SCREEN
- HPT AND VAP LOCATION
- HPT, VAP AND SOIL LOCATION
- LYSIMETER LOCATION
- MONITORING WELL LOCATION

TOTAL PFOS ANALYTICAL

- >100,000
- >10,000 - 100,000
- >1,000 - 10,000
- >100 - 1,000
- >40 - 100
- NON DETECT - 40

EST. HYDRAULIC CONDUCTIVITY (ft/day)

- >125 – 150
- >100 – 125
- >75 – 100
- >50 – 75
- >25 – 50
- >2.5 – 25
- >0.1 – 2.5
- ≥0.1

ESTIMATED GROUNDWATER LEVEL DURING HPT LOGGING

0 20' 40'
VERTICAL SCALE

0 100' 200'
HORIZONTAL SCALE

VERTEBRAE-GRAYLING ARMY AIRFIELD-
GRAYLING, MICHIGAN
**ESTCP FINAL REPORT**

# VERTEBRAE CROSS SECTION LONGSECT

ARCADIS

FIGURE
**G-5**

DIV/GROUP=IMDV DB:G.STOWELL LYR:ON=*;OFF=*REF* ACADVER: 24.2S (LMS TECH) PAGESETUP: TAP PDF PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 4/24/2024 1:48 PM BY: SMITH, ROBERT
C:\Users\bsmith\DC\ACCDocs\Arcadis ACC USA\US-99999999-ESTCP_ARMY AIRFIELD_GRAYLING_MI\Project Files\10_WIP\10T_ARC_ENV\2024101-DWG\GEN CROSS SECTION R2.dwg LAYOUT: X (2) SAVED: 4/24/2024 1:30 PM

# APPENDIX I GROUNDWATER SAMPLING LOGS

# Groundwater Sampling Logs

# Performance Monitoring Event #1

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GMAF | Date: 12/13/2021

Site/Well No.: MW2-VRTB-1D | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1215 End 1220

## Evacuation Data

| | |
|---|---|
| Measuring Point | TOC |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | 30.50 |
| Depth to Water (ft bmp) | 14.98 |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | 15.52 |
| Casing Diameter/Type | 2" PVC |
| Gallons in Well | 2.5 |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | 28 |
| Purge Time | begin 1150 end ~~1225~~ 1220 |
| Pumping Rate (ml/min) | 300 |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | PVC Riser Stainless steel screen |

| Constituents Sampled | Container Description | Number | Preservative | |
|---|---|---|---|---|
| PFAS 537 mod | 250ml poly | 6 | none | MS/MSD |
| DoD QSM Table B-15 | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

# YSI/LOW FLOW SAMPLING LOG



WELL : MW-VRTB-ID PROJ #: 30027244

DATE : 12/13/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1150 | pump on | | | | | | | 300 | | |
| 1155 | | | | | | 7.13 | | ↓ | | 14.98 |
| 1200 | 10.6 | | 0.191 | | 10.33 | 7.26 | 257.3 | | 2.22 | 14.98 |
| 1203 | 10.5 | | 0.198 | | 9.31 | 7.40 | 256.7 | | 0.02 | 14.98 |
| 1206 | 10.4 | | 0.198 | | 9.27 | 7.43 | 255.0 | | 0.02 | 14.98 |
| 1209 | 10.5 | | 0.200 | | 9.21 | 7.48 | 254.5 | ↓ | 0.02 | 14.98 |
| 1212 | 10.6 | | 0.194 | | 9.21 | 7.50 | 252.9 | 300 | 0.02 | 14.98 |
| 1215 | Collected sample | | | MW-VRTB-ID_12132021 | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | 30.50 | | | | | | | | |
| Depth To Water Before Purging: | | | 14.98 | | | | | | | |
| Depth To Water After Purging: | | | 14.98 | | | | | | | |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/13/2021

Site/Well No.: MW-VRTB-1S | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1325 End 1330

## Evacuation Data

| | |
|---|---|
| Measuring Point | TOC |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | 19.50 |
| Depth to Water (ft bmp) | 14.63 |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | 4.87 |
| Casing Diameter/Type | 2" PVC |
| Gallons in Well | 0.78 |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | 17 |
| Purge Time | begin 1243 end 1330 |
| Pumping Rate (ml/min) | 280 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | PVC riser |
| | Stainless steel screen |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod | 250ml poly | 4 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Dup Sample Collected

Sampling Personnel: K Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

# YSI/LOW FLOW SAMPLING LOG



WELL : MW-VRTB - 1S PROJ #: 30027244

DATE : 12/13/2021 LOC: GMAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~1240~~ | | | | | | | | | | |
| 1243 | pump on | | | | | | | 280 | | |
| 1249 | 10.4 | | 0.329 | | 5.32 | 7.37 | 246.9 | | 0.19 | 14.68 |
| 1252 | 10.5 | | 0.328 | | 5.57 | 7.40 | 240.1 | | 0.19 | 14.68 |
| 1255 | 10.4 | | 0.326 | | 5.56 | 7.38 | 237.4 | | | 14.68 |
| 1258 | 10.5 | | 0.326 | | 5.63 | 7.39 | 228.6 | | | |
| 1301 | 10.5 | | 0.325 | | 6.67 | 7.39 | 221.5 | | 0.38 | 14.66 |
| 1304 | 10.3 | | 0.332 | | 5.49 | 7.39 | 208.4 | | | |
| 1307 | 10.4 | | 0.331 | | 5.30 | 7.39 | 201.0 | | | |
| 1310 | 10.4 | | 0.329 | | 5.39 | 7.39 | 183.0 | | | |
| 1313 | 10.3 | | 0.328 | | 5.48 | 7.38 | 176.8 | | 0.02 | 14.66 |
| 1316 | 10.4 | | 0.330 | | 5.32 | 7.38 | 165.0 | | 0.02 | 14.66 |
| 1319 | 10.3 | | 0.327 | | 5.71 | 7.38 | 150.0 | | 0.02 | 14.66 |
| 1322 | 10.4 | | 0.331 | | 5.70 | 7.37 | 140.0 | 280 | 0.02 | 14.66 |
| 1325 | Collected sample MW-VRTB-1S_12132021 and duplicate sample | | | | | | | | | |
| 1330 | pump off | | Dup-01_12132021 | | | | | | | |

| | |
|---|---|
| Total Depth of Well: | 19.50 |
| Depth To Water Before Purging: | 14.63 |
| Depth To Water After Purging: | 14.66 |

3 min interval based on flow through interval

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 3

Site Location: GAAF | Date: 12/13/2021

Site/Well No.: VRTB-S-06 | Replicate No.: | Code No.:

Weather: 38°F sunny | Sampling Time: Begin 1650 End 1652

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated ~15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of horizontal well screen (10' screen) |
| Purge Time | begin 1515 end 1652 |
| Pumping Rate (ml/min) | 350 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | Horizontal well, 5/8" diameter, shallow well, orange segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS - 537 mod DoD QSM Table B-15 | 2 x 250ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

Shallow, Orange

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-S-06 PROJ #: 30027244

DATE: 12/13/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1340 | set up on VRTB-S-08, dedicated tubing in place | | | | | | | | | |
| 1439 | turned on pump, lots of bubbles, uneven flow; troubleshooting | | | | | | | | | |
| 1455 | can't get sufficient water to surface | | | | | | | | | |
| 1500 | setting tubing in VRTB-S-06 | | | | | | | | | |
| 1513 | pump on, few bubbles; 3min intervals based on flush through time through tubing | | | | | | | | | |
| | | | | | | | | | | |
| 1515 | 10.5 | | 1.61 | | | 7.91 | 106.5 | 350 | 0.02 | |
| 1518 | 10.4 | | 1.56 | | 36.69 | 7.47 | 111.1 | ↓ | 0.02 | |
| 1521 | 10.2 | | 1.55 | | 29.70 | 6.38 | 117.6 | ↓ | | |
| 1524 | 10.3 | | 3.73 | | 9.65 | 6.60 | 153.6 | ↓ | | |
| 1527 | 10.3 | | 6.29 | | 6.33 | 6.79 | 157.7 | 350 | | |
| 1530 | 10.2 | | 6.58 | | 4.19 | 6.87 | 154.4 | ↓ | 0.02 | |
| 1533 | 10.1 | | 6.36 | | 2.36 | 6.90 | 151.2 | ↓ | 0.02 | |
| 1536 | 10.2 | | 6.06 | | 2.00 | 6.93 | 149.1 | ↓ | | |
| 1539 | 10.2 | | 5.73 | | 1.87 | 6.96 | 145.7 | ↓ | | |
| 1542 | 10.2 | | 5.23 | | 1.96 | 6.99 | 142.7 | 350 | | |
| 1545 | 10.1 | | 4.67 | | 2.21 | 7.01 | 139.9 | ↓ | | |
| 1548 | 10.2 | | 4.20 | | 2.41 | 7.03 | 137.6 | ↓ | | |
| 1551 | 10.2 | | 3.75 | | 2.71 | 7.06 | 135.6 | ↓ | 0.02 | |
| 1554 | 10.1 | | 3.40 | | 2.99 | 7.07 | 134.0 | 350 | 0.02 | |
| 1557 | | | | | | | | | | |
| 1600 | 10.1 | | 2.96 | | 3.35 | 7.09 | 131.9 | 350 | 0.02 | |
| 1603 | 10.1 | | 2.82 | | 3.52 | 7.10 | 131.3 | ↓ | | |
| 1606 | 10.2 | | 2.69 | | 3.72 | 7.12 | 130.7 | ↓ | | |
| 1609 | 10.0 | | 2.58 | | 3.91 | 7.12 | 130.4 | ↓ | | |
| 1612 | 10.2 | | 2.44 | | 4.09 | 7.13 | 130.2 | ↓ | | |
| 1615 | 10.0 | | 2.39 | | 4.29 | 7.13 | 130.4 | 350 | 0.02 | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

3 min interval based on flow through rate

**ARCADIS**

# YSI/LOW FLOW SAMPLING LOG



WELL : VRTB-S-06 PROJ #: 30027244

DATE : 12/13/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1618 | 10.1 | | 2.28 | | 4.85 | 7.13 | 131.0 | 350 | 0.02 | |
| 1621 | 10.3 | | 2.16 | | 4.99 | 7.12 | 131.2 | ↓ | | |
| 1624 | 10.3 | | 2.13 | | 5.03 | 7.13 | 131.4 | | | |
| 1627 | 10.2 | | 2.07 | | 5.34 | 7.14 | 131.4 | | | |
| 1630 | 10.3 | | 1.89 | | 5.47 | 7.15 | 130.7 | ↓ | | |
| 1633 | 10.3 | | 1.93 | | 6.24 | 7.16 | 130.4 | 350 | 0.02 | |
| 1636 | 10.2 | | 1.83 | | 8.81 | 7.16 | 130.1 | ↓ | | |
| 1639 | 10.2 | | 1.76 | | 8.59 | 7.17 | 129.9 | | | |
| 1642 | 10.1 | | 1.73 | | 8.57 | 7.18 | 129.6 | ↓ | | |
| 1645 | 10.2 | | 1.70 | | 8.50 | 7.18 | 128.5 | 350 | 0.02 | |
| 1650 | Collected | sample | | | VRTB-S-06_12132021 | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Shallow, purple

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 1

Site Location: GAAF | Date: 12/14/2021

Site/Well No.: VRTB-S-P8 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin NA End NA

## Evacuation Data

Measuring Point: NA - horizontal well

MP Elevation (ft):

Land Surface Elevation (ft):

Sounded Well Depth (ft bmp):

Depth to Water (ft bmp):

Water-Level Elevation (ft): estimated ~15 ft bgs

Water Column in Well (ft):

Casing Diameter/Type:

Gallons in Well:

Gallons Pumped/Bailed Prior to Sampling:

Sample Pump Intake Setting (ft bmp): mid point of horizontal well screen (10' screen)

Purge Time: begin 1308 end 1317

Pumping Rate (ml/min): NA

Evacuation Method: peristaltic

## Field Parameters

Temperature (°C):

SpC (mS/cm):

CND (mS/cm):

Dissolved Oxygen (%):

Dissolved Oxygen (mg/L):

pH (s.u.):

ORP (mV):

Turbidity (NTU):

Color:

Odor:

Appearance:

Sampling Method: peristaltic

Remarks: horizontal well, 5/8" diameter

Shallow well, purple segment

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS - 537 mod | 250ml poly | 2 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

Unable to sample - no water in horizontal well screen

No sample collected

Shallow, red

**ARCADIS**

# Water Sampling Log

Project: ESTCP Ventilome | Project No.: 300272441 | Page: 1 of 1

Site Location: GAAF | Date: 12/14/2021

Site/Well No.: VRTB-S-R7 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin NA End NA

## Evacuation Data

Measuring Point: NA - horizontal well

MP Elevation (ft):

Land Surface Elevation (ft):

Sounded Well Depth (ft bmp):

Depth to Water (ft bmp): estimated ~ 15 ft bgs

Water-Level Elevation (ft):

Water Column in Well (ft):

Casing Diameter/Type:

Gallons in Well:

Gallons Pumped/Bailed Prior to Sampling:

Sample Pump Intake Setting (ft bmp): midpoint of 10' horizontal screen

Purge Time: begin 1308 end 1445

Pumping Rate (ml/min): NA

Evacuation Method: peristaltic

## Field Parameters

Temperature (°C):

SpC (mS/cm):

CND (mS/cm):

Dissolved Oxygen (%):

Dissolved Oxygen (mg/L):

pH (s.u.):

ORP (mV):

Turbidity (NTU):

Color:

Odor:

Appearance:

Sampling Method: peristaltic

Remarks: horizontal well 5/8" diameter Shallow well, Red segment

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

Turned on pump - large bubbles in flow line; tried adjustments to pump flow rate, etc. Unable to achieve stable flow rate and flow rate > 50 ml/min. Could not reach stabilization; could not sample location.

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page 1 of 2

Site Location: GAAF | Date: 12/14/2021

Site/Well No.: VRTB-D-B1 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1710 End 1712

**Evacuation Data**

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated ~15' bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1600 end 1712 |
| Pumping Rate (ml/min) | 300 pump max |
| Evacuation Method | peristaltic |

**Field Parameters**

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter deep well, black segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS - 537 mod | 250 ml Poly | 2 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

deep, black

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : VRTB-D-B1 PROJ #: 300272.44

DATE : 12/14/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1600 | pump on | | | | | | | | | |
| 1607 | | | | | | | | 300 | 47.1 | |
| 1616 | | | | | | | | | 52.2 | |
| 1624 | 9.9 | 1.31 | 934 | 166.8 | 18.80 | 11.40 | 76.1 | 300 | | |
| 1627 | 9.8 | 1.24 | 878 | 160.2 | 18.09 | 11.13 | 79.5 | 300 | 22.9 | |
| 1630 | . | . | . | . | . | . | . | . | | |
| 1633 | 9.9 | 1.03 | 733 | 151.5 | 17.11 | 10.63 | 78.6 | 300 | | |
| 1636 | 10.0 | 0.92 | 656 | 137.6 | 15.46 | 10.55 | 76.2 | | | |
| 1639 | 10.0 | 0.83 | 591 | 135.4 | 15.20 | 10.47 | 74.3 | | | |
| 1642 | 9.9 | 0.82 | 580 | 134.3 | 15.14 | 10.46 | 71.0 | | 16.7 | |
| 1645 | 9.9 | 0.82 | 581 | 131.3 | 14.65 | 10.43 | 69.9 | | 15.3 | |
| 1648 | 10.0 | 0.79 | 562 | 129.0 | 14.51 | 10.41 | 68.5 | 300 | | |
| 1651 | 10.0 | 0.80 | 569 | 125.5 | 14.11 | 10.43 | 68.5 | | 14.0 | |
| 1654 | 9.9 | 0.75 | 532 | 123.3 | 13.80 | 10.31 | 68.1 | | | |
| 1657 | 10.0 | 0.73 | 520 | 119.4 | 13.40 | 10.30 | 67.9 | | 15.8 | |
| 1700 | 9.9 | 0.696 | 493.3 | 119.8 | 13.50 | 10.25 | 67.6 | | 15.0 | |
| 1703 | 9.9 | 0.699 | 496.6 | 119.8 | 13.49 | 10.24 | 67.4 | | 14.9 | |
| 1706 | 9.9 | 0.692 | 492.8 | 116.9 | 13.15 | 10.24 | 67.1 | 300 | 15.3 | |
| 1710 | Collect sample | | | VRTB-D-B1_12142021 | | | | | | |
| 1712 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

clear brow

measurement interval based on flow through rate (< 2 min)
interval = 3 min

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/15/2021

Site/Well No.: VRTB-D-G24 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1315 End 1318

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated 15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft screen |
| Purge Time | begin 1135 end 1318 |
| Pumping Rate (ml/min) | 240 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter deep well, green segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS - 537 mod | 250 ml poly | 2 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

deep, green

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : VRTB-D-64 PROJ #: 30027244

DATE : 12/15/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1135 | pump on | | | | | | | | | |
| 1150 | 9.4 | 6.56 | 4.60 | 40.7 | 4.53 | 6.52 | -0.4 | 240 | 0.62 | |
| 1157 | 9.5 | 6.01 | 4.22 | 14.6 | 1.42 | 6.57 | -8.1 | ↓ | | |
| 1200 | 9.6 | 5.41 | 3.78 | 10.4 | 1.16 | 6.61 | -9.7 | | | |
| 1203 | 9.5 | 4.62 | 3.22 | 12.5 | 1.40 | 6.66 | -10.3 | | | |
| 1206 | 9.5 | 3.39 | 2.38 | 18.2 | 2.05 | 6.71 | -11.0 | | | |
| 1209 | 9.6 | 3.04 | 2.13 | 21.1 | 2.47 | 6.73 | -10.8 | ↓ | | |
| 1212 | 9.6 | 2.55 | 1.80 | 26.8 | 3.02 | 6.76 | -10.7 | 240 | 1.14 | |
| 1215 | 9.6 | 2.18 | 1.54 | 30.6 | 3.44 | 6.80 | -10.5 | ↓ | | |
| 1218 | 9.7 | 2.04 | 1.44 | 31.4 | 3.55 | 6.80 | -10.1 | | | |
| 1221 | 9.6 | 1.88 | 1.33 | 33.9 | 3.84 | 6.82 | -10.0 | | | |
| 1224 | 9.6 | 1.70 | 1.20 | 36.4 | 4.13 | 6.85 | -9.9 | | | |
| 1227 | 9.6 | 1.62 | 1.15 | 37.7 | 4.28 | 6.86 | -9.6 | ↓ | | |
| 1230 | 9.7 | 1.53 | 1.08 | 40.7 | 4.62 | 6.88 | -9.5 | 240 | 0.93 | |
| 1233 | 9.8 | 1.47 | 1.04 | 41.2 | 4.65 | 6.88 | -9.4 | ↓ | | |
| 1236 | 9.7 | 1.41 | 1.00 | 43.3 | 4.90 | 6.90 | -9.3 | | | |
| 1239 | 9.7 | 1.34 | 0.95 | 43.0 | 4.85 | 6.91 | -9.0 | | | |
| 1242 | 9.7 | 1.30 | 0.92 | 44.3 | 5.05 | 6.92 | -8.9 | ↓ | | |
| 1245 | 9.7 | 1.24 | 0.88 | 45.5 | 5.15 | 6.94 | -9.0 | 240 | 0.89 | |
| 1248 | 9.7 | 1.17 | 0.84 | 46.9 | 5.31 | 6.93 | -8.2 | ↓ | | |
| 1251 | 9.7 | 1.13 | 0.80 | 46.6 | 5.28 | 6.95 | -8.9 | | | |
| 1254 | 9.7 | 1.09 | 0.77 | 47.4 | 5.38 | 6.97 | -8.9 | | | |
| 1257 | 9.7 | 1.07 | 0.76 | 48.3 | 5.47 | 6.97 | -8.7 | ↓ | | |
| 1300 | 9.9 | 1.03 | 0.74 | 48.9 | 5.52 | 6.98 | -8.6 | 240 | 1.28 | |
| 1303 | 9.8 | 1.01 | 0.72 | 49.6 | 5.60 | 6.99 | -8.6 | ↓ | | |
| 1306 | 9.9 | 0.98 | 0.70 | 50.4 | 5.70 | 7.00 | -8.5 | | 0.88 | |
| 1309 | 9.8 | 0.96 | 0.69 | 50.8 | 5.74 | 7.01 | -8.5 | ↓ | | |
| 1312 | 9.9 | 0.95 | 0.68 | 51.5 | 5.80 | 7.02 | -8.2 | 240 | 0.02 | |
| 1315 Total Depth of Well: | | | Collected sample | | | | VRTB-D-64_1215202 | | | |
| 1318 Depth To Water Before Purging: | | | | pump off | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 3

Site Location: CTAAF | Date: 12/15/2021

Site/Well No.: VRTB-D-S2 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1412 End 1414

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated 15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1240 end 1414 |
| Pumping Rate (ml/min) | 160 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well 5/8" diameter deep well, silver segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod | 250ml Poly | 2 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrack

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

deep, silver

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-D-S2 PROJ #: 30027244

DATE: 12/15/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1240 | pump on | | | | | | | | | |
| 1252 | 8.8 | 8.30 | 5.73 | 53.8 | 6.08 | 5.45 | 44.7 | 160 | 0.02 | |
| 1158 | 8.7 | 8.22 | 5.67 | 48.9 | 5.53 | 5.55 | 33.8 | ↓ | | |
| 1203 | 8.7 | 8.35 | 5.77 | 46.9 | 5.26 | 5.68 | 26.0 | ↓ | | |
| 1208 | 8.8 | 8.35 | 5.75 | 44.4 | 5.01 | 5.78 | 18.5 | ↓ | | |
| 1213 | 8.9 | 8.18 | 5.66 | 43.4 | 4.88 | 5.85 | 12.3 | ↓ | | |
| 1218 | 8.9 | 7.81 | 5.42 | 41.9 | 4.69 | 5.90 | 7.4 | 160 | 0.71 | |
| 1223 | 9.0 | 7.29 | 5.02 | 39.3 | 4.40 | 5.97 | 1.0 | ↓ | | |
| 1228 | 9.0 | 6.81 | 4.72 | 36.4 | 4.03 | 6.02 | -3.5 | ↓ | | |
| 1233 | 9.3 | 6.41 | 4.48 | 32.0 | 3.59 | 6.04 | -5.9 | ↓ | | |
| 1238 | 9.3 | 5.93 | 4.14 | 29.9 | 3.36 | 6.07 | -9.9 | ↓ | | |
| 1243 | 9.2 | 5.65 | 3.95 | 29.5 | 3.31 | 6.09 | -11.7 | 160 | | |
| 1248 | 9.4 | 5.23 | 3.67 | 25.8 | 2.91 | 6.12 | -14.1 | ↓ | | |
| 1253 | 9.6 | 4.92 | 3.45 | 27.9 | 3.11 | 6.13 | -11.4 | ↓ | 1.21 | |
| 1258 | 9.5 | 4.67 | 3.28 | 24.0 | 2.72 | 6.14 | -16.6 | ↓ | | |
| 1301 | 9.6 | 4.47 | 3.15 | 24.1 | 2.72 | 6.16 | -17.5 | ↓ | | |
| 1306 | 9.6 | 4.21 | 2.96 | 24.1 | 2.73 | 6.17 | -18.4 | 160 | | |
| 1311 | 9.6 | 4.01 | 2.83 | 24.6 | 2.74 | 6.18 | -18.7 | ↓ | | |
| 1316 | 9.7 | 3.85 | 2.72 | 24.9 | 2.80 | 6.19 | -13.5 | ↓ | | |
| 1321 | 9.7 | 3.69 | 2.60 | 26.2 | 2.95 | 6.20 | -8.8 | ↓ | | |
| 1326 | 9.7 | 3.57 | 2.53 | 26.5 | 2.96 | 6.20 | -5.9 | ↓ | 1.13 | |
| 1331 | 9.6 | 3.46 | 2.45 | 27.0 | 3.07 | 6.21 | -4.2 | ↓ | | |
| 1336 | 9.5 | 3.37 | 2.38 | 27.1 | 3.03 | 6.22 | -4.4 | ↓ | | |
| 1341 | 9.7 | 3.27 | 2.31 | 27.1 | 3.04 | 6.23 | -5.1 | 160 | | |
| 1346 | 9.7 | 3.19 | 2.25 | 27.3 | 3.08 | 6.23 | -5.6 | ↓ | | |
| 1351 | 9.7 | 3.09 | 2.18 | 28.8 | 3.19 | 6.24 | -5.5 | ↓ | 3.38 | |
| 1356 | 9.7 | 3.05 | 2.16 | 30.3 | 3.39 | 6.25 | -6.1 | ↓ | 3.46 | |
| 1401 | 9.7 | 2.98 | 2.10 | 29.6 | 3.40 | 6.26 | -7.6 | 160 | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

5 min interval based on flow through rate

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : VRTB-D-S2 PROJ #: 30027244

DATE : 12/15/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1406 | 9.7 | 2.93 | 2.07 | 32.8 | 3.08 | 6.27 | -9.0 | 160 | 3.63 | |
| 1411 | 9.7 | 2.87 | 2.03 | 37.2 | 4.19 | 6.27 | -11.7 | 160 | 3.42 | |
| 1412 | Collected | VRTB-D-S2-12 | 152021 | | | | | | | |
| 1414 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page 1 of 2

Site Location: GAAF | Date: 12/15/2021

Site/Well No.: VRTB-D-Y3 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1508 End 1510

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated 15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1348 end 1510 |
| Pumping Rate (ml/min) | 200 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter deep well, yellow segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod | 250ml poly | 2 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrack

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

deep, yellow

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-D-Y3 PROJ #: 30027244

DATE: 12/15/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1348 | pump on | | | | | | | | | |
| 1355 | 9.4 | 8.11 | 5.69 | 12.5 | 1.34 | 6.02 | 34.1 | 200 | 4.64 | |
| 1358 | 9.6 | 7.35 | 3.52 | 5.2 | 0.58 | 6.57 | -9.6 | ↓ | | |
| 1401 | 9.6 | 6.43 | 4.47 | 10.2 | 1.15 | 6.71 | -20.7 | | | |
| 1404 | 9.7 | 4.97 | 3.50 | 18.6 | 2.09 | 6.72 | -23.3 | | | |
| 1407 | 9.6 | 4.00 | 2.83 | 27.7 | 3.22 | 6.74 | -23.5 | | | |
| 1410 | 9.7 | 3.13 | 2.22 | 36.7 | 4.16 | 6.77 | -22.9 | ↓ | | |
| 1413 | 9.9 | 2.30 | 1.52 | 47.3 | 5.33 | 6.80 | -20.5 | 200 | 0.67 | |
| 1416 | 9.8 | 2.05 | 1.45 | 50.2 | 5.65 | 6.81 | -19.4 | ↓ | | |
| 1419 | | | | | | | | | | |
| 1422 | 9.8 | 1.60 | 1.13 | 54.8 | 6.20 | 6.86 | -18.0 | | | |
| 1425 | 9.8 | 1.45 | 1.03 | 56.7 | 6.39 | 6.90 | -18.2 | | | |
| 1428 | 9.8 | 1.39 | 0.99 | 57.1 | 6.45 | 6.88 | -16.7 | ↓ | | |
| 1431 | 9.9 | 1.31 | 0.93 | 57.8 | 6.51 | 6.90 | -16.4 | 200 | 0.15 | |
| 1434 | 9.9 | 1.24 | 0.88 | 58.2 | 6.55 | 6.92 | -16.2 | ↓ | | |
| 1437 | 9.9 | 1.17 | 0.83 | 59.2 | 6.70 | 6.90 | -14.6 | | | |
| 1440 | 9.8 | 1.06 | 0.75 | 60.2 | 6.83 | 6.96 | -15.4 | | | |
| 1443 | 9.8 | 1.04 | 0.73 | 60.3 | 6.82 | 6.96 | -14.9 | | 0.02 | |
| 1446 | 9.8 | 0.94 | 0.64 | 62.3 | 7.05 | 7.01 | -15.6 | | | |
| 1449 | 9.8 | 0.96 | 0.68 | 62.2 | 7.02 | 6.99 | -14.4 | ↓ | | |
| 1452 | 9.9 | 0.95 | 0.68 | 62.4 | 7.04 | 6.99 | -13.3 | 200 | 0.02 | |
| 1455 | 9.8 | 0.91 | 0.64 | 62.2 | 7.04 | 7.03 | -14.4 | ↓ | | |
| 1458 | 9.7 | 0.91 | 0.65 | 62.5 | 7.07 | 7.03 | -14.3 | | | |
| 1501 | 9.8 | 0.85 | 0.60 | 63.0 | 7.12 | 7.07 | -15.1 | | 0.02 | |
| 1504 | 9.8 | 0.86 | 0.61 | 62.9 | 7.13 | 7.06 | -14.1 | ↓ | 0.02 | |
| 1507 | 9.9 | 0.86 | 0.61 | 63.0 | 7.10 | 7.07 | -14.1 | 200 | 0.02 | |
| 1508 | Collected sample VRTB-D-Y3 12152021 | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/15/2021

Site/Well No.: VRTB-S-MS | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1640 End 1647

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated 15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal well screen |
| Purge Time | begin 1552 end 1647 |
| Pumping Rate (ml/min) | 175 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter shallow well, magenta (pink) segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod | 250ml poly | 2 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

Shallow, magenta

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-S-MS PROJ #: 30027244

DATE: 12/15/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1552 | pump on | | | | | | | | | |
| 1600 | | | | | | | | 175 | 10.6 | |
| 1605 | 9.5 | 3.58 | 2.52 | 45.7 | 5.16 | 6.78 | 26.9 | 175 | | |
| 1608 | 9.5 | 3.65 | 2.57 | 57.9 | 6.51 | 6.74 | 29.9 | ↓ | 20.7 | |
| 1611 | 9.6 | 3.69 | 2.60 | 60.4 | 6.80 | 6.72 | 32.2 | ↓ | | |
| 1614 | 9.5 | 3.78 | 2.67 | 54.5 | 6.09 | 6.68 | 34.9 | ↓ | 30.6 | |
| 1617 | 9.6 | 3.85 | 2.72 | 51.5 | 5.79 | 6.66 | 36.6 | ↓ | | |
| 1620 | 9.7 | 3.96 | 2.80 | 44.8 | 5.02 | 6.61 | 39.5 | 175 | | |
| 1623 | 9.7 | 4.16 | 2.94 | 39.0 | 4.36 | 6.55 | 42.7 | ↓ | 38.2 | |
| 1626 | 9.7 | 4.20 | 2.97 | 36.5 | 4.09 | 6.54 | 43.6 | ↓ | | |
| 1629 | 9.9 | 4.29 | 3.05 | 33.5 | 3.75 | 6.52 | 45.5 | ↓ | 40.8 | |
| 1632 | 9.6 | 4.39 | 3.09 | 32.7 | 3.68 | 6.51 | 47.5 | ↓ | 41.6 | |
| 1635 | 9.7 | 4.39 | 3.11 | 33.5 | 3.73 | 6.52 | 49.1 | ↓ | 42.5 | |
| 1638 | 9.8 | 4.38 | 3.11 | 34.0 | 3.80 | 6.51 | 50.2 | 175 | 41.3 | |
| ~~1641~~ | | | | | | | | | | |
| 1640 | Collected | sample | VRTB-S-MS_ | 12152021 | | | | | | |
| 1647 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 8

Site Location: GAAF | Date: 12/17/2021

Site/Well No.: CMT-VRTB-01 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin: End:

## Evacuation Data

| | |
|---|---|
| Measuring Point | TOC |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated 15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | 7 CMT ports |
| Purge Time | begin ____ end ____ |
| Pumping Rate (ml/min) | |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | unable to measure DTW in CMT well |

| Constituents Sampled | Container Description | Number | Preservative | |
|---|---|---|---|---|
| TOP Assay - includes analysis equivalent to 537 mod DoD QSM Table B-15 | poly 250ml | 2 | none | per sample |
| | | | | |
| | | | | one sample collected from CMT port |
| | | | | |
| | | | | |
| True TOF | poly 250 ml | 2 | none | total of 7 CMT ports |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: CMT-VRTB-01-1 PROJ #: 30027244

DATE: 12/17/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 920 | set up for sampling | | sampling systems | | at CMT well. Can't measure depth to water in CMT well small diameter well does not fit in CMT ports sampled at the same time; see additional pages | | | 2 | simultaneous | |
| 1430 | pump on - bubbles in flow line | | | | | | | 350 | | |
| 1435 | 10.0 | 0.309 | 0.221 | 76.7 | 8.68 | 7.82 | 105.8 | | 27.4 | |
| 1437 | 10.0 | 0.310 | 0.221 | 90.2 | 10.17 | 7.82 | 105.4 | | 12.7 | |
| 1439 | 10.0 | 0.309 | 0.220 | 89.9 | 10.23 | 7.82 | 105.8 | | | |
| 1441 | 10.0 | 0.309 | 0.220 | 84.7 | 9.67 | 7.82 | 105.4 | | | |
| 1443 | 10.0 | 0.310 | 0.221 | 75.0 | 8.46 | 7.82 | 104.3 | 350 | 5.73 | |
| 1445 | 10.0 | 0.310 | 0.221 | 90.3 | 10.17 | 7.82 | 108.2 | | 8.64 | |
| 1447 | 10.1 | 0.310 | 0.222 | 88.2 | 10.11 | 7.81 | 105.7 | | | |
| 1449 | 10.0 | 0.311 | 0.222 | 90.0 | 10.18 | 7.82 | 103.7 | | 5.42 | |
| 1451 | 10.1 | 0.311 | 0.223 | 75.5 | 8.42 | 7.82 | 105.0 | | | |
| 1453 | 10.0 | 0.311 | 0.222 | 91.9 | 10.37 | 7.81 | 102.2 | | 5.22 | |
| 1455 | 10.2 | 0.310 | 0.223 | 86.0 | 9.69 | 7.81 | 98.0 | 350 | | |
| 1457 | 9.9 | 0.312 | 0.222 | 83.8 | 9.39 | 7.80 | 97.6 | | 6.76 | |
| 1459 | 10.0 | 0.312 | 0.222 | 89.2 | 10.02 | 7.80 | 96.6 | | 5.64 | |
| 1501 | 9.8 | 0.312 | 0.221 | 73.1 | 8.25 | 7.79 | 96.2 | | 7.14 | |
| 1503 | 10.0 | 0.312 | 0.222 | 92.3 | 10.43 | 7.80 | 92.9 | | 7.21 | |
| 1505 | 10.0 | 0.312 | 0.223 | 74.6 | 8.40 | 7.80 | 93.3 | | | |
| 1507 | 10.0 | 0.313 | 0.223 | 73.9 | 8.36 | 7.80 | 94.2 | | 4.28 | |
| 1509 | 9.9 | 0.313 | 0.223 | 92.5 | 10.49 | 7.81 | 93.5 | | 2.62 | |
| 1511 | 10.0 | 0.312 | 0.223 | 74.5 | 8.38 | 7.80 | 95.3 | 350 | 2.71 | |
| 1513 | Collected sample CMT-VRTB-01-1_12172021 pump off | | | | | | | | | |
| Total Depth of Well: | | 1520 | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

2 min interval based on flow rate interval

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: CMT-VRTB-01-2 PROJ #: 30027244

DATE: 12/17/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1336 | pump on | | | | | | | 200 | | |
| 1345 | | | | | | | | ↓ | 0.66 | |
| 1348 | 9.5 | 0.312 | 0.220 | 29.0 | 3.31 | 7.73 | 47.6 | | | |
| 1350 | 9.4 | 0.313 | 0.219 | 27.7 | 3.16 | 7.72 | 44.4 | ↓ | 0.02 | |
| 1352 | | | | | | | | 200 | | |
| 1354 | 9.4 | 0.312 | 0.219 | 27.0 | 3.10 | 7.71 | 39.3 | ↓ | | |
| 1356 | 9.5 | 0.312 | 0.220 | 26.5 | 3.03 | 7.69 | 42.9 | ↓ | 0.02 | |
| 1358 | 9.5 | 0.312 | 0.220 | 26.2 | 2.99 | 7.70 | 44.2 | 200 | 0.67 | |
| 1400 | Collected sample | | | CMT-VRTB-01-2_12172021 | | | | | | |
| 1402 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

2 min interval based on flow rate interval

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : CMT-VRTB-01-3 PROJ #: 30027244

DATE : 12/17/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1133 | pump on | | | | | | | 350 | | |
| 1141 | 10.0 | 0.298 | 0.212 | 79.2 | 8.93 | 7.78 | 147.6 | | 0.12 | |
| 1143 | 10.1 | 0.298 | 0.213 | 77.3 | 8.68 | 7.77 | 148.4 | | | |
| 1145 | 10.1 | 0.298 | 0.213 | 80.5 | 9.01 | 7.78 | 147.9 | | 0.44 | |
| 1147 | 10.2 | 0.297 | 0.213 | 79.3 | 8.90 | 7.76 | 148.0 | | 1.28 | |
| 1149 | 10.3 | 0.298 | 0.214 | 78.6 | 8.79 | 7.76 | 146.4 | | 1.26 | |
| 1151 | 10.4 | 0.298 | 0.214 | 78.7 | 8.81 | 7.76 | 146.2 | 350 | 1.19 | |
| | | | | | | | | | | |
| 1157 | Collected | Sample | CMT-VRTB-01-3 | 12172021 | | | | | | |

| | |
|---|---|
| Total Depth of Well: | |
| Depth To Water Before Purging: | |
| Depth To Water After Purging: | |

2 min interval based on flow through rate

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: CMT-VRTB-01-4 PROJ #: 30027244

DATE: 12/17/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1050 | pump on | | | | | | | 200 | 14.4 | |
| | | | | | | | | 200 | | |
| 1058 | 10.2 | 0.315 | 0.226 | 56.4 | 6.33 | 7.79 | 150.5 | 200 | | |
| 1100 | 10.3 | 0.315 | 0.227 | 55.0 | 6.17 | 7.79 | 150.0 | ↓ | | |
| 1102 | 10.2 | 0.314 | 0.227 | 54.5 | 6.10 | 7.79 | 149.7 | ↓ | 7.85 | |
| 1104 | 10.3 | 0.315 | 0.227 | 53.8 | 6.03 | 7.78 | 149.3 | ↓ | | |
| 1106 | 10.4 | 0.315 | 0.227 | 53.5 | 5.98 | 7.78 | 148.7 | ↓ | 4.45 | |
| 1108 | 10.4 | 0.314 | 0.227 | 53.5 | 5.98 | 7.78 | 148.2 | 200 | | |
| 1110 | 10.3 | 0.315 | 0.226 | 54.2 | 6.11 | 7.79 | 147.5 | ↓ | 5.26 | |
| 1112 | 10.4 | 0.314 | 0.227 | 54.2 | 6.05 | 7.79 | 146.9 | ↓ | 2.73 | |
| 1114 | 10.3 | 0.314 | 0.226 | 55.0 | 6.16 | 7.80 | 146.3 | ↓ | 3.45 | |
| 1116 | 10.4 | 0.314 | 0.227 | 55.1 | 6.16 | 7.80 | 145.9 | 200 | 2.79 | |
| 1118 | Collected sample CMT-VRTB-01-4_12172021 | | | | | | | | | |
| 1120 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

2 min interval based on flow through rate

**ARCADIS**

# YSI/LOW FLOW SAMPLING LOG



WELL: CMT-VRTB-01-5 PROJ #: 30027244

DATE: 12/17/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1333 | pump on | | | | | | | 270 | | |
| 1345 | | | | | | | | ↓ | 0.02 | |
| 1348 | 9.3 | 0.264 | 0.184 | 73.0 | 8.42 | 8.00 | 20.7 | ↓ | | |
| 1350 | 9.3 | 0.264 | 0.185 | 73.0 | 8.36 | 7.99 | 28.5 | ↓ | 0.49 | |
| 1352 | | | | | | | | ↓ | | |
| 1354 | 9.3 | 0.265 | 0.185 | 72.7 | 8.32 | 7.99 | 33.2 | ↓ | | |
| 1356 | 9.3 | 0.265 | 0.185 | 73.2 | 8.40 | 7.99 | 37.5 | ↓ | 0.50 | |
| 1358 | 9.4 | 0.265 | 0.186 | 73.7 | 8.44 | 7.99 | 43.3 | ↓ | | |
| 1400 | 9.4 | | 0.186 | 73.9 | 8.51 | 7.99 | 48.3 | 270 | | |
| 1402 | 9.4 | 0.265 | 0.186 | 74.3 | 8.52 | 7.98 | 50.6 | ↓ | 0.39 | |
| 1404 | 9.6 | 0.266 | 0.186 | 75.1 | 8.65 | 7.99 | 56.3 | ↓ | | |
| 1406 | 9.5 | 0.264 | 0.187 | 73.4 | 8.40 | 7.98 | 60.5 | ↓ | | |
| 1408 | 9.7 | 0.265 | 0.188 | 75.2 | 8.53 | 7.98 | 65.2 | ↓ | 0.02 | |
| 1410 | 9.8 | 0.265 | 0.188 | 76.8 | 8.72 | 7.99 | 71.4 | ↓ | 0.02 | |
| 1412 | 10.0 | 0.266 | 0.189 | 76.0 | 8.58 | 7.98 | 75.5 | ↓ | 0.02 | |
| 1414 | 9.9 | 0.265 | 0.189 | 76.1 | 8.62 | 7.99 | 79.2 | 270 | 0.02 | |
| 1416 | collected sample CMT-VRTB-01-5_12172021 | | | | | | | | | |
| | | | | | | | | | | |
| 1422 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

2 min interval based on flow through rate

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: CMT-VRTB-01-6 PROJ #: 300027244

DATE: 12/17/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1133 | pump on | | | | | | | 300 | | |
| | | | | | | | | ↓ | | |
| 1140 | 9.2 | 0.229 | 0.160 | 85.6 | 9.87 | 8.19 | 90.6 | | 1.09 | |
| 1142 | 9.2 | 0.229 | 0.160 | 81.9 | 9.40 | 8.19 | 86.5 | | | |
| 1144 | 9.1 | 0.229 | 0.159 | 80.8 | 9.33 | 8.18 | 83.2 | | 3.32 | |
| 1146 | 9.2 | 0.228 | 0.159 | 77.9 | 8.95 | 8.17 | 80.2 | | | |
| 1148 | 9.2 | 0.228 | 0.159 | 78.3 | 8.97 | 8.18 | 78.6 | | 0.92 | |
| 1150 | 9.5 | 0.226 | 0.160 | 78.6 | 8.98 | 8.17 | 76.3 | | | |
| 1152 | 9.5 | 0.226 | 0.159 | 78.9 | 9.00 | 8.17 | 74.9 | 300 | 0.42 | |
| 1155 | Collected | sample | | CMT-VRTB-01-6 | | | -1217 | 2021 | | |
| 1157 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

2 min interval based on flow through rate

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : CMT-VRTB-01-7 PROJ #: 300272414

DATE : 12/17/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1050 | pump on | | | | | | | 175 | 0.02 | |
| | | | | | | | | ↓ | | |
| 1059 | 9.3 | 0.163 | 0.114 | 63.5 | 7.24 | 8.26 | 85.3 | | 2.48 | |
| 1101 | 9.4 | 0.161 | 0.113 | 62.9 | 7.23 | 8.27 | 83.2 | | | |
| 1103 | 9.4 | 0.161 | 0.112 | 64.3 | 7.36 | 8.27 | 80.8 | | 4.33 | |
| 1105 | 9.4 | 0.160 | 0.112 | 66.5 | 7.59 | 8.27 | 78.6 | | 2.42 | |
| 1107 | 9.4 | 0.160 | 0.113 | 66.3 | 7.57 | 8.27 | 76.0 | | 3.09 | |
| 1109 | | | | | | | | 175 | | |
| 1110 | Collected | sample | CMT-VRTB-01-7_ | 12172021 | | | | | | |
| 1112 | pump | off | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

2 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page 1 of 2

Site Location: GMAAF | Date: 12/21/2021

Site/Well No.: VRTB-D-06 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1421 End 1425

## Evacuation Data

| | |
|---|---|
| Measuring Point | MA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated 15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1236 end 1425 |
| Pumping Rate (ml/min) | 300 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter deep well, orange segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod DOD QSM Table B-15 | 250 poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

deep, orange

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-D-06 PROJ #: 30027244

DATE: 12/21/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1236 | pump on | | | | | | | 300 | | |
| 1258 | | | | | | | | | 4.24 | |
| 1300 | 8.4 | 3.14 | 2.12 | 14.4 | 1.67 | 6.51 | -72.1 | | | |
| 1303 | 8.3 | 2.51 | 1.71 | 22.0 | 2.55 | 6.56 | -67.0 | | | |
| 1306 | 8.4 | 2.34 | 1.59 | 26.2 | 3.07 | 6.59 | -64.6 | | 3.01 | |
| 1309 | 8.5 | 2.13 | 1.46 | 32.1 | 3.65 | 6.62 | -60.7 | | | |
| 1312 | 8.7 | 1.99 | 1.37 | 34.8 | 4.00 | 6.64 | -57.8 | | | |
| 1315 | 8.4 | 1.93 | 1.32 | 35.9 | 4.21 | 6.66 | -56.5 | 300 | 2.93 | |
| 1318 | 8.5 | 1.78 | 1.22 | 39.4 | 4.60 | 6.68 | -54.0 | | | |
| 1324 | 8.5 | 1.54 | 1.05 | 45.4 | 5.29 | 6.73 | -48.6 | | | |
| 1327 | 8.3 | 1.44 | 0.98 | 50.9 | 5.97 | 6.76 | -45.9 | | | |
| 1330 | 8.4 | 1.37 | 0.94 | 51.8 | 6.05 | 6.77 | -44.8 | | | |
| 1333 | 8.4 | 1.34 | 0.92 | 52.2 | 6.10 | 6.78 | -43.2 | 300 | 0.62 | |
| 1336 | 8.4 | 1.28 | 0.87 | 52.9 | 6.16 | 6.79 | -41.4 | | | |
| 1339 | 8.6 | 1.22 | 0.84 | 55.2 | 6.27 | 6.81 | -40.1 | | | |
| 1342 | 8.3 | 1.18 | 0.80 | 54.1 | 6.39 | 6.83 | -38.6 | | | |
| 1345 | 8.6 | 1.13 | 0.77 | 54.4 | 6.33 | 6.84 | -37.0 | | | |
| 1348 | 8.5 | 1.09 | 0.75 | 53.7 | 6.27 | 6.85 | -35.7 | 300 | 2.02 | |
| 1351 | 8.7 | 1.07 | 0.74 | 55.2 | 6.40 | 6.86 | -35.3 | | | |
| 1354 | 8.6 | 1.05 | 0.72 | 55.2 | 6.40 | 6.86 | -33.6 | | | |
| 1357 | 8.6 | 1.02 | 0.70 | 56.2 | 6.55 | 6.88 | -32.0 | | | |
| 1400 | 8.5 | 0.98 | 0.67 | 57.0 | 6.62 | 6.89 | -30.7 | | | |
| 1403 | 8.6 | 0.96 | 0.66 | 60.7 | 7.04 | 6.90 | -30.4 | 300 | 1.38 | |
| 1406 | 8.4 | 0.94 | 0.64 | 61.2 | 7.15 | 6.91 | -29.5 | | 1.22 | |
| 1409 | 8.6 | 0.92 | 0.63 | 60.9 | 7.08 | 6.92 | -28.5 | | 1.12 | |
| 1412 | 8.8 | 0.89 | 0.61 | 60.8 | 7.11 | 6.94 | -28.0 | | 1.16 | |
| 1415 | 8.8 | 0.88 | 0.60 | 61.0 | 7.08 | 6.94 | -27.0 | | 1.08 | |
| 1418 | 8.6 | 0.86 | 0.59 | 61.4 | 7.18 | 6.94 | -26.6 | 300 | 1.02 | |
| Total Depth of Well: | 1421 | Collected sample VRTB-D-06_12212021 | | | | | | | | |
| Depth To Water Before Purging: | 1425 | pump off | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

sulfur smell

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/21/2021

Site/Well No.: VRTB-D-P8 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1424 End 1427

## Evacuation Data

Measuring Point: NA - horizontal well

MP Elevation (ft):

Land Surface Elevation (ft):

Sounded Well Depth (ft bmp):

Depth to Water (ft bmp): estimated ~15 ft bgs

Water-Level Elevation (ft):

Water Column in Well (ft):

Casing Diameter/Type:

Gallons in Well:

Gallons Pumped/Bailed Prior to Sampling:

Sample Pump Intake Setting (ft bmp): midpoint of 10 ft horizontal screen

Purge Time: begin 1247 end 1427

Pumping Rate (ml/min): 300 pump max

Evacuation Method: peristaltic

## Field Parameters

Temperature (°C):

SpC (mS/cm):

CND (mS/cm):

Dissolved Oxygen (%):

Dissolved Oxygen (mg/L):

pH (s.u.):

ORP (mV):

Turbidity (NTU):

Color:

Odor:

Appearance:

Sampling Method: peristaltic

Remarks: horizontal well, 5/8" diameter deep well, purple segment

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS - 537 mod DoD QSM Table B-15 | 250 ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

deep, purple

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-D-P8 PROJ #: 30027244

DATE: 12/21/2021 LOC: GMAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1247 | pump on | | | | | | | 300 | | | |
| 1258 | | | | | | | | | 87.5 | | yellow color water |
| 1300 | 8.2 | 4.04 | 2.75 | 199.4 | 23.15 | 12.25 | 170.0 | | | | |
| 1303 | 8.2 | 3.99 | 2.70 | 198.7 | 23.13 | 12.26 | 153.3 | | | | |
| 1306 | 8.1 | 3.68 | 2.48 | 195.6 | 22.91 | 12.22 | 144.2 | | 74.1 | | |
| 1309 | 8.4 | 3.36 | 2.29 | 192.2 | 22.43 | 12.18 | 136.8 | | | | |
| 1312 | 8.3 | 3.18 | 2.16 | 191.4 | 22.17 | 12.17 | 129.8 | | | | |
| 1315 | 8.0 | 3.00 | 2.03 | 188.0 | 22.13 | 12.16 | 123.7 | | 53.3 | | |
| 1318 | 8.1 | 2.81 | 1.90 | 185.7 | 21.70 | 12.12 | 118.1 | | | | |
| 1321 | | | | | | | | ↓ | | | |
| 1324 | 8.2 | 2.42 | 1.64 | 179.1 | 20.78 | 12.01 | 108.5 | | | | |
| 1327 | 8.2 | 2.20 | 1.49 | 173.2 | 20.12 | 11.96 | 99.5 | 300 | | | |
| 1330 | 8.2 | 2.14 | 1.45 | 172.2 | 20.30 | 11.95 | 96.9 | | | | |
| 1333 | 8.1 | 2.05 | 1.38 | 169.0 | 19.84 | 11.92 | 92.3 | | 39.2 | | |
| 1336 | 8.5 | 1.96 | 1.34 | 164.8 | 19.31 | 11.85 | 89.7 | | | | |
| 1339 | 8.5 | 1.87 | 1.28 | 163.8 | 19.02 | 11.93 | 84.1 | | | | |
| 1342 | 8.3 | 1.81 | 1.23 | 162.4 | 19.03 | 11.82 | 80.9 | | | | |
| 1345 | 8.4 | 1.72 | 1.18 | 157.0 | 18.25 | 11.77 | 76.2 | | | | |
| 1348 | 8.4 | 1.68 | 1.15 | 155.2 | 18.12 | 11.75 | 72.5 | | 36.8 | | |
| 1351 | 8.5 | 1.62 | 1.11 | 153.4 | 17.99 | 11.72 | 70.3 | | | | |
| 1354 | 8.5 | 1.59 | 1.09 | 152.0 | 17.70 | 11.71 | 68.4 | | | | |
| 1357 | 8.2 | 1.53 | 1.04 | 150.4 | 17.80 | 11.68 | 65.6 | ↓ | | | |
| 1400 | 8.3 | 1.49 | 1.01 | 149.3 | 17.47 | 11.63 | 64.0 | | | | |
| 1403 | 8.5 | 1.46 | 1.00 | 146.1 | 17.03 | 11.60 | 61.2 | 300 | 33.8 | | |
| 1406 | 8.4 | 1.42 | 0.97 | 144.8 | 16.94 | 11.58 | 58.2 | | 34.6 | | |
| 1409 | 8.5 | 1.32 | 0.93 | 141.9 | 16.60 | 11.52 | 55.9 | | 33.1 | | clear water |
| 1412 | 8.6 | 1.33 | 0.92 | 139.3 | 16.18 | 11.49 | 54.1 | | 33.2 | | |
| 1415 | 8.7 | 1.30 | 0.90 | 137.5 | 15.96 | 11.45 | 51.0 | | 34.4 | | |
| 1418 | Total Depth of Well: 8.5 | 1.27 | 0.87 | 136.8 | 15.94 | 11.43 | 48.3 | ↓ | 34.7 | | |
| 1421 | Depth To Water Before Purging: 8.5 | 1.26 | 0.87 | 136.2 | 15.85 | 11.41 | 47.6 | 300 | 33.5 | | |
| | Depth To Water After Purging: | 1424 | Collected sample | | | | VRTB-D-P8 | | 12212021 | | |

3 min interval 1427 pump off based on flow through interval

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page 1 of 2

Site Location: GAAF | Date: 12/21/2021

Site/Well No.: VRTB-D-MS | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1605 End 1608

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated ~15' bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1433 end 1604 |
| Pumping Rate (ml/min) | 2100 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter deep well, magenta segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod DoD QSM Table B-15 | 250 ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

deep, magenta

**ARCADIS**

# YSI/LOW FLOW SAMPLING LOG



WELL : VRTB-D-MS PROJ #: 30027244

DATE : 12/21/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1433 | pump on | | | | | | | 200 | | |
| 1445 | | | | | | | | | 9.14 | |
| 1448 | 8.60 | 2.31 | 1.58 | 3.1 | 0.32 | 6.89 | -59.6 | | | |
| 1451 | 8.5 | 1.90 | 1.30 | 3.8 | 0.44 | 6.94 | -62.7 | | | |
| 1454 | 8.5 | 1.44 | 0.99 | 8.3 | 0.97 | 7.02 | -64.8 | | 1.93 | |
| 1457 | 8.5 | 1.26 | 0.87 | 10.1 | 1.17 | 7.06 | -65.1 | | | |
| 1500 | 8.4 | 1.12 | 0.76 | 12.8 | 1.52 | 7.09 | -63.4 | | | |
| 1503 | 8.7 | 1.00 | 0.69 | 13.0 | 1.53 | 7.14 | -63.0 | 200 | | |
| 1506 | | | | | | | | | | |
| 1509 | 8.6 | 0.91 | 0.62 | 14.2 | 1.65 | 7.18 | -61.7 | | 15.0 | |
| 1512 | 8.7 | 0.85 | 0.59 | 14.5 | 1.69 | 7.21 | -61.1 | | | |
| 1515 | 8.4 | 0.81 | 0.56 | 15.4 | 1.77 | 7.23 | -60.1 | | | |
| 1518 | 8.5 | 0.77 | 0.53 | 16.0 | 1.88 | 7.25 | -58.6 | | | |
| 1521 | 8.5 | 0.74 | 0.51 | 17.0 | 1.98 | 7.26 | -56.9 | | | |
| 1524 | 8.4 | 0.714 | 0.487 | 18.1 | 2.08 | 7.27 | -54.5 | | 6.10 | |
| 1527 | 8.8 | 0.695 | 0.479 | 19.2 | 2.20 | 7.29 | -53.5 | 200 | | |
| 1530 | 8.5 | 0.671 | 0.462 | 20.6 | 2.39 | 7.31 | -52.7 | | | |
| 1533 | 8.6 | 0.663 | 0.455 | 20.9 | 2.44 | 7.32 | -52.0 | | | |
| 1536 | 8.6 | 0.644 | 0.442 | 21.7 | 2.56 | 7.33 | -52.2 | | | |
| 1539 | 8.5 | 0.630 | 0.431 | 23.0 | 2.71 | 7.35 | -48.6 | | | |
| 1542 | 8.3 | 0.618 | 0.420 | 23.7 | 2.78 | 7.35 | -47.2 | | 8.57 | |
| 1545 | 8.6 | 0.609 | 0.417 | 24.5 | 2.82 | 7.37 | -46.8 | | | |
| 1548 | 8.5 | 0.593 | 0.407 | 37.1 | 4.32 | 7.39 | -44.8 | | 8.40 | |
| 1551 | 8.7 | 0.590 | 0.406 | 36.6 | 4.26 | 7.39 | -42.5 | | 6.80 | |
| 1554 | 8.5 | 0.576 | 0.395 | 37.1 | 4.30 | 7.41 | -39.3 | | 6.75 | |
| 1557 | 8.5 | 0.573 | 0.391 | 43.7 | 5.11 | 7.42 | -38.3 | | 4.80 | |
| 1600 | 8.3 | 0.569 | 0.387 | 43.7 | 5.13 | 7.43 | -37.2 | | 6.68 | |
| 1603 | 8.5 | 0.561 | 0.384 | 45.7 | 5.30 | 7.44 | -35.2 | 200 | 6.40 | |
| Total Depth of Well: | | | 1605 | Collected | sample | VRTB-D-MS | 12212021 | | | |
| Depth To Water Before Purging: | | | 1608 | pump off | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/21/2021

Site/Well No.: VRTB-D-R7 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1545 End 1547

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated ~15' bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1438 end 1547 |
| Pumping Rate (ml/min) | 230 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter deep well, reel segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod DoD QSM Table B-15 | 250ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | |
|---|---|---|---|---|
| 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

dup. rec

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-D-R7 PROJ #: 30027244

DATE: 12/21/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1438 | pump on | | | | | | | 230 | | |
| 1445 | | | | | | | | ↓ | 4.31 | |
| 1448 | 7.9 | 7.65 | 5.16 | 97.4 | 11.26 | 6.47 | 59.6 | | | |
| 1451 | 7.8 | 7.30 | 4.90 | 111.6 | 12.96 | 6.54 | 49.1 | | | |
| 1454 | 7.4 | 7.03 | 4.67 | 110.4 | 12.91 | 6.58 | 41.1 | | 13.5 | |
| 1457 | 7.5 | 6.88 | 4.59 | 152.3 | 17.91 | 6.62 | 34.5 | | | |
| 1500 | 7.3 | 6.77 | 4.27 | 158.1 | 18.71 | 6.64 | 28.9 | | | |
| 1503 | 7.6 | 6.17 | 4.12 | 163.6 | 19.20 | 6.62 | 22.0 | 230 | | |
| 1506 | | | | | | | | ↓ | | |
| 1509 | 7.7 | 5.50 | 3.69 | 138.6 | 16.54 | 6.61 | 16.6 | | 23.4 | |
| 1512 | 8.3 | 5.42 | 3.68 | 131.1 | 14.90 | 6.46 | 17.9 | | | |
| 1515 | 8.3 | 5.55 | 3.77 | 120.0 | 13.71 | 6.41 | 18.0 | | | |
| 1518 | 7.5 | 5.76 | 3.83 | 144.3 | 16.99 | 6.48 | 12.4 | | | |
| 1521 | 7.5 | 5.25 | 3.49 | 157.6 | 18.54 | 6.56 | 7.5 | | | |
| 1524 | 7.6 | 4.80 | 3.20 | 134.0 | 15.69 | 6.59 | 2.8 | | 6.53 | |
| 1527 | 7.7 | 4.77 | 3.21 | 172.0 | 19.74 | 6.61 | 0.8 | | 6.58 | |
| 1530 | 7.5 | 4.78 | 3.18 | 168.8 | 20.01 | 6.62 | -0.3 | | 6.74 | |
| 1533 | 8.1 | 4.58 | 3.12 | 130.4 | 14.87 | 6.60 | -1.6 | | 6.62 | |
| 1536 | 8.3 | 4.45 | 3.03 | 111.6 | 12.90 | 6.58 | -2.8 | | 6.57 | |
| 1539 | 8.2 | 4.48 | 3.05 | 95.4 | 11.08 | 6.55 | -1.4 | ↓ | 6.54 | |
| 1542 | 8.5 | 4.39 | 3.01 | 94.2 | 10.83 | 6.55 | -3.1 | 230 | 6.58 | |
| 1545 | Collected sample VRTB-D-R7_12212021 | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

3 min interval based on flow through ~~rate~~ rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GMAF | Date: 12/23/2021

Site/Well No.: VRTB-S-04 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1125 End 1127

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated ~15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | mid point of 10 ft horizontal screen |
| Purge Time | begin 1034 end 1127 |
| Pumping Rate (ml/min) | 400 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter shallow well, green segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 multiple DoD QSM Table B-15 | 250ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

Shallow, green

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : VRTB-S-64 PROJ #: 30027244

DATE : 12/23/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1034 | pump on | | | | | | | 400 | | |
| 1040 | | | | | | | | | 0.92 | |
| 1054 | 8.5 | 1.29 | 0.88 | 61.7 | 7.19 | 7.85 | 60.8 | | | |
| 1057 | 8.6 | 1.30 | 0.89 | 62.3 | 7.25 | 7.87 | 59.3 | | 3.11 | |
| 1100 | 8.7 | 1.32 | 0.91 | 62.0 | 7.25 | 7.88 | 57.9 | | | |
| 1103 | 8.7 | 1.34 | 0.92 | 62.8 | 7.28 | 7.89 | 56.4 | | | |
| 1106 | 8.5 | 1.37 | 0.94 | 63.5 | 7.40 | 7.88 | 55.0 | | 0.02 | |
| 1109 | — | | | | | | | | | |
| 1112 | 8.8 | 1.42 | 0.98 | 64.0 | 7.39 | 7.89 | 51.9 | | | |
| 1115 | 8.9 | 1.44 | 1.00 | 65.2 | 7.52 | 7.90 | 50.6 | | 0.02 | |
| 1118 | 9.1 | 1.46 | 1.02 | 65.4 | 7.51 | 7.90 | 49.0 | ↓ | | |
| 1121 | 9.0 | 1.48 | 1.03 | 65.9 | 7.58 | 7.91 | 47.5 | 400 | 0.02 | |
| 1125 | Collected | | single | VRTB-S-64-12232021 | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/23/2021

Site/Well No.: VRTB-S-S2 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1145 End 1147

## Evacuation Data

| | |
|---|---|
| Measuring Point | MA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated 15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1038 end 1147 |
| Pumping Rate (ml/min) | 400 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well 5/8" diameter shallow well, silver segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod | 250 ml poly | 2 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

Shallow, silver

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-S-S2 PROJ #: 30027244

DATE: 12/23/2021 LOC: BAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1038 | pump on | | | | | | | 400 | | |
| 1040 | | | | | | | | ↓ | 29.0 | |
| 1054 | 8.2 | 1.49 | 1.01 | 26.8 | 3.15 | 6.95 | 21.8 | | | |
| 1057 | 8.5 | 1.36 | 0.93 | 31.1 | 3.59 | 6.94 | 20.7 | | 14.3 | |
| 1100 | 8.4 | 1.29 | 0.88 | 33.9 | 3.96 | 6.95 | 19.1 | | | |
| 1103 | 8.4 | 1.24 | 0.84 | 36.2 | 4.27 | 6.95 | 16.7 | | | |
| 1106 | 8.2 | 1.19 | 0.81 | 39.0 | 4.60 | 6.96 | 12.9 | ↓ | 7.75 | |
| 1109 | | | | | | | | | | |
| 1112 | 8.7 | 1.13 | 0.78 | 43.7 | 5.12 | 7.02 | 6.8 | 400 | | |
| 1115 | 8.5 | 1.11 | 0.76 | 45.0 | 5.20 | 7.04 | 6.6 | ↓ | | |
| 1118 | 8.9 | 1.07 | 0.74 | 46.9 | 5.41 | 7.04 | 5.6 | | | |
| 1121 | 8.6 | 1.02 | 0.70 | 49.2 | 5.72 | 7.08 | 4.2 | | 2.83 | |
| 1124 | 8.6 | 0.99 | 0.68 | 49.2 | 5.73 | 7.07 | 4.8 | | | |
| 1127 | 8.6 | 0.95 | 0.66 | 49.7 | 5.82 | 7.10 | 5.0 | | | |
| 1130 | 8.6 | 0.94 | 0.64 | 52.2 | 6.06 | 7.10 | 5.7 | | 1.14 | |
| 1133 | 8.8 | 0.91 | 0.62 | 52.7 | 6.15 | 7.13 | 9.5 | | | |
| 1136 | 8.2 | 0.88 | 0.60 | 53.5 | 6.26 | 7.13 | 14.8 | | 1.73 | |
| 1139 | 8.1 | 0.87 | 0.59 | 52.9 | 6.26 | 7.13 | 16.9 | | | |
| 1142 | 8.5 | 0.85 | 0.58 | 53.5 | 6.28 | 7.10 | 21.5 | ↓ | 1.81 | |
| 1145 | Collected sample VRTB-S-S2_12232021 | | | | | | | 400 | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GIAAF | Date: 12/23/2021

Site/Well No.: VRTB-S-Y3 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1227 End 1229

## Evacuation Data

| | |
|---|---|
| Measuring Point | MP - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated 15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1137 end 1229 |
| Pumping Rate (ml/min) | 370 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter shallow well, yellow segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod | 250 ml poly | 2 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

Shallow, yellow

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-S-Y3 PROJ #: 30027244

DATE: 12/23/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1137 | pump on | | | | | | | 370 | | |
| 1145 | | | | | | | | | 1.75 | |
| 1148 | 9.1 | 3.81 | 2.65 | 6.6 | 0.75 | 6.80 | -17.1 | | | |
| 1151 | 9.0 | 3.10 | 2.15 | 6.7 | 3.09 | 6.88 | -26.9 | | | |
| 1154 | | | | | | | | | | |
| 1157 | 9.0 | 2.85 | 1.97 | 8.5 | 0.98 | 6.91 | -30.8 | | 2.54 | |
| 1200 | 9.0 | 2.65 | 1.83 | 10.8 | 1.25 | 6.91 | -32.7 | | | |
| 1203 | 9.2 | 2.44 | 1.70 | 13.0 | 1.49 | 6.90 | -33.6 | | | |
| 1206 | 9.1 | 2.29 | 1.59 | 15.5 | 1.77 | 6.90 | -34.6 | 370 | 4.86 | |
| 1209 | 9.1 | 2.22 | 1.55 | 16.6 | 1.90 | 6.90 | -35.2 | | | |
| 1212 | 8.6 | 2.17 | 1.49 | 16.9 | 1.96 | 6.90 | -35.3 | | | |
| 1215 | 8.5 | 2.12 | 1.45 | 17.4 | 2.02 | 6.90 | -35.3 | | 4.29 | |
| 1218 | 8.6 | 1.82 | 1.25 | 19.2 | 2.24 | 6.96 | -38.5 | | | |
| 1221 | 8.7 | 1.79 | 1.23 | 20.3 | 2.35 | 6.96 | -37.8 | | | |
| 1224 | 8.7 | 1.78 | 1.23 | 21.1 | 2.44 | 6.95 | -37.4 | 370 | 3.68 | |
| 1227 | Collect sample | | | VRTB-S-Y3 _ 12232021 | | | | | | |
| ~~1233~~ | | | | | | | | | | |

| | |
|---|---|
| Total Depth of Well: | |
| Depth To Water Before Purging: | |
| Depth To Water After Purging: | |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/23/2021

Site/Well No.: VRTB-S-B1 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1314 End 1320

## Evacuation Data

| | |
|---|---|
| Measuring Point | AA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated ~15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1156 end 1320 |
| Pumping Rate (ml/min) | 325 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/4" diameter, shallow well, black segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod | 250ml poly | 2 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

shallow, black

**ARCADIS**

# YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-S-B1 PROJ #: 30027244

DATE: 12/23/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1156 | pump on | | | | | | | 325 | | |
| 1200 | 8.0 | 7.34 | 4.96 | 3.0 | 0.45 | 6.56 | 29.1 | ↓ | 12.2 | |
| 1203 | 8.4 | 6.84 | 4.66 | 2.6 | 0.33 | 6.62 | 11.5 | | | |
| 1206 | 8.3 | 6.25 | 4.25 | 2.8 | 0.32 | 6.66 | -1.4 | | 2.96 | |
| 1209 | 8.2 | 5.91 | 4.01 | 3.8 | 0.41 | 6.68 | -7.0 | | | |
| 1212 | 8.4 | 5.41 | 3.69 | 4.2 | 0.47 | 6.72 | -13.6 | | | |
| 1215 | 8.9 | 5.07 | 3.50 | 5.1 | 0.57 | 6.73 | -16.6 | | 5.20 | |
| 1218 | 9.1 | 4.69 | 3.26 | 5.9 | 0.68 | 6.76 | -19.3 | | | |
| 1221 | 8.7 | 4.23 | 2.91 | 6.2 | 0.66 | 6.79 | -22.1 | | | |
| 1224 | 8.7 | 4.09 | 2.81 | 6.3 | 0.78 | 6.80 | -22.8 | | 3.92 | |
| 1227 | 8.4 | 3.83 | 2.61 | 7.5 | 0.88 | 6.82 | -24.1 | | | |
| 1230 | 8.3 | 3.60 | 2.45 | 8.3 | 0.95 | 6.84 | -24.2 | | | |
| 1233 | 8.0 | 3.37 | 2.27 | 9.2 | 1.07 | 6.86 | -23.6 | | 1.59 | |
| 1236 | 8.1 | 3.28 | 2.22 | 9.4 | 1.11 | 6.86 | -22.9 | | | |
| 1239 | 8.3 | 3.22 | 2.19 | 10.2 | 1.21 | 6.86 | -20.3 | | 0.49 | |
| 1242 | 8.2 | 3.07 | 2.09 | 10.8 | 1.29 | 6.87 | -19.8 | | | |
| 1245 | 8.1 | 2.95 | 2.00 | 11.8 | 1.39 | 6.89 | -19.5 | | | |
| 1248 | 8.0 | 2.80 | 1.89 | 12.5 | 1.48 | 6.90 | -19.9 | | | |
| 1251 | 8.2 | 2.72 | 1.85 | 14.1 | 1.65 | 6.91 | -20.2 | | 0.02 | |
| 1254 | 8.2 | 2.64 | 1.79 | 14.9 | 1.78 | 6.91 | -21.1 | | | |
| 1257 | 8.2 | 2.55 | 1.73 | 17.5 | 2.07 | 6.92 | -21.5 | | | |
| 1300 | 8.3 | 2.48 | 1.69 | 17.6 | 2.07 | 6.93 | -22.6 | | 0.02 | |
| 1303 | 8.2 | 2.50 | 1.70 | 18.0 | 2.16 | 6.92 | -22.9 | | | |
| 1306 | 8.1 | 2.37 | 1.61 | 19.6 | 2.29 | 6.94 | -23.7 | | | |
| 1309 | 8.2 | 2.30 | 1.56 | 20.4 | 2.37 | 6.95 | -24.0 | | 0.02 | |
| 1312 | 8.2 | 2.28 | 1.55 | 21.9 | 2.55 | 6.94 | -23.3 | | | |
| 1315 | 8.4 | 2.26 | 1.53 | 22.7 | 2.65 | 6.95 | -23.6 | 325 | 0.02 | |
| 1318 | Collect sample | | | VRTB-S-B1_1223 | | | 2021 | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/23/2021

Site/Well No.: VRTB-L-MS | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1575 End 1578

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated ~15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1438 end 1518 |
| Pumping Rate (ml/min) | 250 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter longest, magenta segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537mod DoD QSM Table B-15 | 250ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

longsect, magenta

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-L-MS PROJ #: 30027244

DATE: 12/23/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1438 | pump on | | | | | | | | | |
| | troubleshooting - tubing freezing and breaking away from pump | | | | | | | | | |
| 1450 | | | | | | | | 250 | | |
| 1455 | | | | | | | | | 2.28 | |
| 1457 | 9.1 | 2.38 | 1.66 | 3.0 | 0.36 | 6.70 | -53.8 | | | |
| 1500 | 9.1 | 2.40 | 1.67 | 2.1 | 0.28 | 6.69 | -54.9 | | 4.58 | |
| 1503 | 9.0 | 2.40 | 1.67 | 2.0 | 0.23 | 6.69 | -56.6 | | | |
| 1506 | 9.0 | 2.40 | 1.67 | 1.9 | 0.22 | 6.69 | -58.4 | | 5.70 | |
| 1509 | 9.2 | 2.38 | 1.66 | 1.7 | 0.20 | 6.68 | -59.1 | | 5.77 | |
| 1512 | 9.2 | 2.36 | 1.64 | 1.4 | 0.16 | 6.69 | -59.9 | 250 | 6.40 | |
| 1515 | Collected sample VRTB-L-MS_1223 2021 | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Strong sulfur smell

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 3

Site Location: GMAFF | Date: 12/23/2021

Site/Well No.: VRTB-L-P7 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1638 End 1640

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated ~15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10' horizontal screen |
| Purge Time | begin 1444 end 1640 |
| Pumping Rate (ml/min) | 300 pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter longest purple segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod DoD QSM Table B-15 | 250 ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | |
|---|---|---|---|---|
| 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

longseed, purple

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : VRTB-L-P7 PROJ #: 30027244

DATE : 12/23/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1444 | pump on | | | | | | | | | |
| 1450 | | | | | | | | 300 | | |
| 1455 | | | | | | | | | 15.9 | |
| 1457 | 9.2 | 10.98 | 7.64 | 2.2 | 0.25 | 6.18 | -19.8 | | | |
| 1500 | 9.2 | 10.55 | 7.38 | 2.0 | 0.22 | 6.21 | -19.9 | | | |
| 1503 | 9.3 | 9.91 | 6.94 | 1.8 | 0.20 | 6.27 | -20.8 | | | |
| 1506 | 9.2 | 9.60 | 6.71 | 1.8 | 0.19 | 6.29 | -21.3 | | 6.71 | |
| 1509 | 9.4 | 9.26 | 6.50 | 1.7 | 0.18 | 6.31 | -22.2 | | 5.09 | |
| 1512 | 9.3 | 8.63 | 6.03 | 1.5 | 0.17 | 6.35 | -24.0 | | 3.30 | |
| 1515 | 9.3 | 8.52 | 5.96 | 1.5 | 0.17 | 6.37 | -24.3 | | | |
| 1518 | 9.3 | 8.00 | 5.60 | 1.4 | 0.15 | 6.40 | -26.1 | | | |
| 1521 | 9.3 | 7.71 | 5.40 | 1.3 | 0.15 | 6.42 | -27.1 | | 1.62 | |
| 1524 | 9.2 | 7.31 | 5.10 | 1.3 | 0.14 | 6.45 | -28.6 | | | |
| 1527 | 9.2 | 7.01 | 4.89 | 1.2 | 0.13 | 6.47 | -30.0 | 300 | | |
| 1530 | 9.3 | 6.82 | 4.77 | 1.1 | 0.13 | 6.48 | -30.9 | | 1.04 | |
| 1533 | 9.2 | 6.47 | 4.52 | 1.2 | 0.13 | 6.50 | -32.1 | | | |
| 1536 | 9.3 | 6.16 | 4.31 | 1.1 | 0.13 | 6.53 | -33.7 | | | |
| 1539 | 9.4 | 5.88 | 4.13 | 1.0 | 0.12 | 6.55 | -35.3 | | | |
| 1542 | 9.2 | 5.65 | 3.94 | 1.2 | 0.13 | 6.57 | -36.7 | | 1.03 | |
| 1545 | | | | | | | | | | |
| 1548 | 9.4 | 5.22 | 3.66 | 1.9 | 0.21 | 6.60 | -38.8 | | | |
| 1551 | 9.3 | 5.13 | 3.59 | 1.7 | 0.19 | 6.61 | -39.3 | | | |
| 1554 | 9.4 | 5.01 | 3.51 | 1.5 | 0.17 | 6.62 | -40.2 | | 1.17 | |
| 1557 | 9.4 | 4.88 | 3.43 | 1.5 | 0.17 | 6.63 | -41.0 | | | |
| 1600 | 9.4 | 4.76 | 3.34 | 1.5 | 0.17 | 6.65 | -41.6 | | | |
| 1603 | 9.4 | 4.64 | 3.26 | 1.5 | 0.17 | 6.66 | -42.6 | | | |
| 1606 | 9.4 | 4.52 | 3.17 | 1.6 | 0.18 | 6.67 | -43.0 | | | |
| 1609 | 9.4 | 4.39 | 3.09 | 1.6 | 0.18 | 6.68 | -43.7 | 300 | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Strong sulfur smell

3 min interval based on flow through rate

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-L-P7 PROJ #: 30027244

DATE: 12/23/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1612 | 9.6 | 4.31 | 3.04 | 1.8 | 0.20 | 6.69 | -44.3 | 300 | | |
| 1615 | 9.5 | 4.18 | 2.94 | 1.9 | 0.21 | 6.70 | -45.4 | | | |
| 1618 | 9.5 | 4.10 | 2.88 | 2.0 | 0.23 | 6.71 | -46.0 | | 1.60 | |
| 1621 | 9.5 | 3.99 | 2.81 | 2.3 | 0.26 | 6.72 | -46.8 | | 0.02 | |
| 1624 | 9.5 | 3.93 | 2.76 | 2.4 | 0.27 | 6.73 | -47.2 | | | |
| 1627 | 9.5 | 3.83 | 2.70 | 2.4 | 0.27 | 6.74 | -47.8 | | 0.02 | |
| 1630 | 9.4 | 3.75 | 2.63 | 2.7 | 0.31 | 6.75 | -48.4 | | 0.02 | |
| 1633 | 9.6 | 3.68 | 2.60 | 2.8 | 0.32 | 6.76 | -48.8 | ↓ | 0.02 | |
| 1636 | 9.5 | 3.63 | 2.56 | 3.1 | 0.34 | 6.76 | -49.3 | 300 | 0.02 | |
| 1639 | Collected sample VRTB-L-P7 _ 1223 2021 | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertflow | Project No.: 30027244 | Page: 1 of 2

Site Location: GMAAF | Date: 12/27/2021

Site/Well No.: VRTB-L-S2 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1147 End 1150

## Evacuation Data

| | |
|---|---|
| Measuring Point | N/A - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated ~15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1015 end 1150 |
| Pumping Rate (ml/min) | 350, pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter, long sect, silver segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod | 250mL poly | 2 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K Husbrecke

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

longest, silver

**ARCADIS**

# YSI/LOW FLOW SAMPLING LOG



WELL : VRTB-L-S2 PROJ #: 30027244

DATE : 12/27/2021 LOC: GMAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1015 | pump on | | | | | | | | | |
| 1020 | | | | | | | | 350 | | |
| 1025 | | | | | | | | 350 | 1.67 | |
| 1030 | 10.1 | 3.54 | 253 | 4.2 | 0.46 | 6.50 | -65.8 | | | |
| 1033 | 10.2 | 3.16 | 2.27 | 3.7 | 0.37 | 6.55 | -70.1 | | | |
| 1036 | 10.3 | 2.98 | 2.14 | 3.1 | 0.34 | 6.57 | -148.0 | | | |
| 1039 | 10.2 | 2.75 | 1.97 | 2.7 | 0.36 | 6.61 | -137.9 | | 0.02 | |
| 1042 | 10.1 | 2.58 | 1.84 | 3.4 | 0.35 | 6.63 | -143.4 | | | |
| 1045 | 10.2 | 2.45 | 1.76 | 3.6 | 0.36 | 6.65 | -145.1 | | | |
| 1048 | 10.2 | 2.26 | 1.62 | 4.1 | 0.46 | 6.68 | -100.4 | | 0.02 | |
| 1051 | 10.4 | 2.20 | 1.58 | 4.7 | 0.51 | 6.69 | -126.8 | | | |
| 1054 | 10.3 | 2.08 | 1.50 | 5.4 | 0.64 | 6.71 | -148.7 | | | |
| 1057 | 10.2 | 2.03 | 1.45 | 6.0 | 0.70 | 6.72 | -151.8 | | | |
| 1100 | 10.2 | 1.95 | 1.40 | 7.0 | 0.78 | 6.74 | -138.9 | 350 | 0.02 | |
| 1103 | 10.2 | 1.86 | 1.33 | 8.4 | 0.92 | 6.75 | -109.1 | | | |
| 1106 | 10.2 | 1.83 | 1.31 | 8.7 | 0.99 | 6.76 | -97.8 | | | |
| 1109 | 10.4 | 1.73 | 1.25 | 10.9 | 1.22 | 6.78 | -98.9 | | | |
| 1112 | | | | | | | | | 0.02 | |
| 1115 | 10.2 | 1.69 | 1.21 | 13.7 | 1.55 | 6.79 | -129.6 | | | |
| 1118 | 10.2 | 1.65 | 1.18 | 15.5 | 1.69 | 6.80 | -96.0 | | | |
| 1121 | 10.1 | 1.61 | 1.15 | 16.4 | 1.84 | 6.81 | -86.6 | | 0.02 | |
| 1124 | 10.3 | 1.56 | 1.12 | 18.5 | 2.04 | 6.83 | -81.3 | | | |
| 1127 | 10.3 | 1.53 | 1.10 | 19.6 | 2.17 | 6.84 | -73.3 | | | |
| 1130 | | | | | | | | | 0.02 | |
| 1133 | 10.3 | 1.48 | 1.07 | 22.2 | 2.48 | 6.86 | -64.0 | | | |
| 1136 | 10.3 | 1.46 | 1.05 | 22.6 | 2.58 | 6.86 | -165.5 | | | |
| 1139 | 10.3 | 1.44 | 1.03 | 23.7 | 2.65 | 6.87 | -115.0 | | 0.02 | |
| 1142 | 10.3 | 1.41 | 1.01 | 25.3 | 2.85 | 6.88 | -77.4 | | | |
| 1145 Total Depth of Well: | 10.3 | 1.39 | 1.00 | 26.0 | 2.90 | 6.89 | -65.4 | 350 | 0.02 | |
| Depth To Water Before Purging: | | 1147 | Collected | sample | VRTB-L-S2_12272021 | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Sulfur odor.

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page 1 of 2

Site Location: EAAF | Date: 12/27/2021

Site/Well No.: VRTB-L-04 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1100 End 1104

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated ~15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1015 end 1104 |
| Pumping Rate (ml/min) | 250, pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter longest, green segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod DoD QSM Table B-15 | 250ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Harbuck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

longsect, green

**ARCADIS**

# YSI/LOW FLOW SAMPLING LOG



WELL : VRTB-L-G4 PROJ #: 30027244

DATE : 12/27/2021 LOC: GRAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1015 | pump on | | | | | | | | | |
| 1020 | | | | | | | | 250 | | |
| 1025 | | | | | | | | | 0.02 | |
| 1030 | 9.7 | 0.651 | 0.461 | 28.0 | 3.16 | 7.33 | 28.5 | | | |
| 1033 | 9.7 | 0.645 | 0.457 | 28.4 | 3.21 | 7.33 | 21.8 | | | |
| 1036 | 9.7 | 0.646 | 0.458 | 28.4 | 3.20 | 7.32 | 18.1 | | 0.02 | |
| 1039 | 9.7 | 0.647 | 0.458 | 28.2 | 3.19 | 7.31 | 14.4 | | | |
| 1042 | 9.7 | 0.648 | 0.459 | 27.6 | 3.12 | 7.29 | 11.2 | | | |
| 1045 | 9.7 | 0.649 | 0.459 | 28.2 | 3.19 | 7.29 | 9.2 | | 0.02 | |
| 1048 | 9.8 | 0.651 | 0.462 | 27.7 | 3.16 | 7.28 | 5.9 | | 0.02 | |
| 1051 | 9.8 | 0.653 | 0.464 | 27.7 | 3.13 | 7.28 | 3.0 | | 0.02 | |
| 1054 | 9.7 | 0.652 | 0.461 | 27.5 | 3.11 | 7.27 | 1.6 | ↓ | 0.02 | |
| 1057 | 9.6 | 0.653 | 0.461 | 28.2 | 3.19 | 7.27 | 0.5 | 250 | 0.02 | |
| 1100 | Collected | single | VRTB-L-G4_12272021 | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Silty odors

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/27/2021

Site/Well No.: VRTB-L-Y3 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1148 End 1151

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated ~15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal well |
| Purge Time | begin 1115 end 1151 |
| Pumping Rate (ml/min) | 330, pmp max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter longest yellow segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod DoD QSM Table B-15 | 250ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

longest, yellow

**ARCADIS**

# YSI/LOW FLOW SAMPLING LOG



WELL : VRTB-L-Y3 PROJ #: 30027244

DATE : 12/27/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1115 | pump on | | | | | | | | | |
| 1120 | | | | | | | | 330 | | |
| 1121 | 9.9 | 1.07 | 0.706 | 55.7 | 6.27 | 7.26 | -1.0 | | 1.86 | |
| 1124 | 10.0 | 0.677 | 0.481 | 58.1 | 6.54 | 7.24 | 2.8 | | | |
| 1127 | 10.0 | 0.533 | 0.396 | 57.5 | 6.47 | 7.23 | 4.9 | | 3.86 | |
| 1130 | 10.0 | 0.545 | 0.389 | 57.5 | 6.48 | 7.23 | 5.8 | | | |
| 1133 | 9.9 | 0.536 | 0.384 | 57.1 | 6.40 | 7.23 | 7.3 | | 0.02 | |
| 1136 | 10.0 | 0.534 | 0.380 | 56.8 | 6.41 | 7.24 | 8.4 | | | |
| 1139 | 10.0 | 0.530 | 0.376 | 56.9 | 6.43 | 7.24 | 9.3 | | 0.02 | |
| 1142 | 10.0 | 0.525 | 0.374 | 56.6 | 6.39 | 7.24 | 9.9 | ↓ | | |
| 1145 | 10.0 | 0.518 | 0.370 | 57.3 | 6.46 | 7.24 | 10.2 | 330 | 0.02 | |
| 1148 | Collected sample VRTB-L-Y3_12272021 | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page 1 of 2

Site Location: GSAAF | Date: 12/27/2021

Site/Well No.: VRTB-L-B1 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1242 End 1245

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA - horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated 15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10ft horizontal screen |
| Purge Time | begin 1157 end 1245 |
| Pumping Rate (ml/min) | 350, pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter longest black segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod DoD QSM Table B-15 | 250 ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Harbrecht

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

longseat, black

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : VRTB-L-B1 PROJ #: 30027244

DATE : 12/27/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1157 | pump on | | | | | | | | | |
| 1205 | | | | | | | | 350 | | |
| 1209 | 10.2 | 2.91 | 2.08 | 0.9 | 0.09 | 9.05 | -168.2 | | 24.9 | |
| 1212 | 10.1 | 2.78 | 1.99 | 0.8 | 0.08 | 9.16 | -174.9 | | | |
| 1215 | 10.1 | 2.70 | 1.94 | 0.7 | 0.08 | 9.13 | -179.4 | | 15.6 | |
| 1218 | 10.2 | 2.65 | 1.90 | 0.7 | 0.08 | 9.11 | -185.6 | | | |
| 1221 | 10.3 | 2.61 | 1.87 | 0.7 | 0.07 | 9.08 | -190.9 | | | |
| 1224 | 10.2 | 2.56 | 1.83 | 0.7 | 0.08 | 9.03 | -196.1 | | 9.62 | |
| 1227 | 10.2 | 2.51 | 1.80 | 0.6 | 0.08 | 8.99 | -199.7 | | | |
| 1230 | 10.3 | 2.47 | 1.77 | 0.7 | 0.08 | 8.96 | -202.5 | | | |
| 1233 | 10.2 | 2.43 | 1.74 | 0.8 | 0.09 | 8.93 | -205.0 | | 8.45 | |
| 1236 | 10.4 | 2.39 | 1.72 | 0.8 | 0.09 | 8.90 | -205.7 | | 8.27 | |
| 1239 | 10.4 | 2.36 | 1.70 | 0.8 | 0.09 | 8.86 | -206.8 | 350 | 8.17 | |
| 1242 | Collected | Sample | VRTB-L-B1_1227 | 2021 | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Strong sulfur odors

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/27/2021

Site/Well No.: VRTB-L-BB8 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1355 End 1358

## Evacuation Data

| | |
|---|---|
| Measuring Point | NA horizontal well |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | estimated 15 ft bgs |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | midpoint of 10 ft horizontal screen |
| Purge Time | begin 1323 end 1358 |
| Pumping Rate (ml/min) | 450, pump max |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | horizontal well, 5/8" diameter longest, baby blue segment |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod | 250ml poly | 2 | none |
| DoD QSM Table B-15 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

longneck, baby blue

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: VRTB-L-BB8 PROJ #: 30027244

DATE: 12/27/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1323 | pump on | | | | | | | | | |
| 1325 | | | | | | | | 450 | 1.02 | |
| 1330 | 9.7 | 1.07 | 0.76 | 10.9 | 1.24 | 7.21 | -64.8 | | 2.26 | |
| 1333 | 9.8 | 1.02 | 0.72 | 11.9 | 1.35 | 7.15 | -61.6 | | | |
| 1336 | 9.8 | 1.01 | 0.72 | 12.5 | 1.42 | 7.11 | -59.0 | | | |
| 1339 | 9.8 | 0.99 | 0.70 | 13.5 | 1.52 | 7.05 | -54.3 | | 1.09 | |
| 1342 | 9.8 | 0.98 | 0.69 | 13.9 | 1.57 | 7.06 | -53.8 | | 2.27 | |
| 1345 | 9.9 | 0.96 | 0.69 | 14.8 | 1.57 | 7.05 | -52.3 | | 2.47 | |
| 1348 | 9.9 | 0.96 | 0.68 | 15.4 | 1.74 | 7.03 | -50.5 | | 2.50 | |
| 1351 | 10.0 | 0.95 | 0.68 | 16.6 | 1.87 | 7.02 | -49.3 | ↓ | 2.31 | |
| 1354 | 9.9 | 0.94 | 0.67 | 16.8 | 1.90 | 7.02 | -48.7 | 450 | 2.18 | |
| 1355 | collected | single | VRTB-L | BB8 | 12272021 | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Verdoorae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/27/2021

Site/Well No.: MW-VRTB - 2S | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1509 End 1570

## Evacuation Data

| | |
|---|---|
| Measuring Point | TOC |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | 20.54 |
| Depth to Water (ft bmp) | 14.05 |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | 6.49 |
| Casing Diameter/Type | 2" PVC |
| Gallons in Well | 1.04 |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | 18.5 |
| Purge Time | begin 1445 end 1570 |
| Pumping Rate (ml/min) | 450 |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | PVC riser<br>Stainless steel screen |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod<br>DoD QSM Table B-15 | 250 ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | |
|---|---|---|---|---|
| 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

# YSI/LOW FLOW SAMPLING LOG



WELL: MW-VRTB-2S PROJ #: 30027244

DATE: 12/27/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1445 | pump on | | | | | | | | | 14.05 |
| 1448 | | | | | | | | | | |
| 1451 | | | | | | | | 450 | 25.0 | |
| 1454 | 10.1 | 0.357 | 0.256 | 71.9 | 8.09 | 7.76 | -53.4 | | 13.8 | 14.08 |
| 1457 | 10.4 | 0.356 | 0.257 | 69.7 | 7.79 | 7.74 | -49.4 | | 5.57 | 14.07 |
| 1500 | 10.3 | 0.355 | 0.255 | 69.6 | 7.79 | 7.74 | -46.0 | | 4.85 | 14.07 |
| 1503 | 10.2 | 0.356 | 0.256 | 68.3 | 7.67 | 7.73 | -42.4 | V | 3.65 | 14.07 |
| 1506 | 10.2 | 0.355 | 0.255 | 68.3 | 7.66 | 7.74 | -40.4 | 450 | 3.38 | 14.06 |
| 1509 | Collected | Sample | MW-VRTB-2S | | | | 12272021 | | | |
| ~~1518~~ | | | | | | | | | | |

| | |
|---|---|
| Total Depth of Well: | 20.54 |
| Depth To Water Before Purging: | 14.05 |
| Depth To Water After Purging: | 14.06 |

3 min interval based on flow through rate

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/27/2021

Site/Well No.: MW-VRTB-2D | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1535 End 1538

## Evacuation Data

| | |
|---|---|
| Measuring Point | |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | 30.45 |
| Depth to Water (ft bmp) | 14.00 |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | 16.45 |
| Casing Diameter/Type | 2" PVC |
| Gallons in Well | 2.63 |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | 28.5 |
| Purge Time | begin 1516 end 1538 |
| Pumping Rate (ml/min) | 500 |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | PVC riser stainless steel screen |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod DoD QSM Table B-15 | 250ml poly | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : MW-VRTB-2D PROJ #: 30027244

DATE : 12/27/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1516 | pump on | | | | | | | | | 14.00 |
| 1521 | 9.8 | 0.302 | 0.215 | 81.6 | 9.23 | 7.84 | -33.4 | 500 | 13.4 | 14.02 |
| 1524 | 10.0 | 0.301 | 0.215 | 78.1 | 8.81 | 7.85 | -32.2 | ↓ | 3.51 | 14.02 |
| 1527 | 9.9 | 0.302 | 0.215 | 78.7 | 8.90 | 7.85 | -29.6 | ↓ | 2.41 | 14.01 |
| 1530 | 10.0 | 0.302 | 0.216 | 78.4 | 8.86 | 7.84 | -28.6 | ↓ | 1.64 | 14.02 |
| 1533 | 9.9 | 0.301 | 0.214 | 78.0 | 8.82 | 7.84 | -27.0 | 500 | 1.71 | 14.02 |
| 1535 | Collect | single | MW-VRTB-2D_ | | | | 12272021 | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | 30.45 | | | | | | | | |
| Depth To Water Before Purging: | | | 14.00 | | | | | | | |
| Depth To Water After Purging: | | | 14.02 | | | | | | | |

3 min interval based on flow through interval

**ARCADIS**

# Water Sampling Log

Project: ESTCP Vertebrae | Project No.: 30027244 | Page: 1 of 2

Site Location: GAAF | Date: 12/27/2021

Site/Well No.: MW-VRTB-3 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1639 End 1643

## Evacuation Data

| | |
|---|---|
| Measuring Point | TOC |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | 19.58 |
| Depth to Water (ft bmp) | 13.79 |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | 5.79 |
| Casing Diameter/Type | 2" PVC |
| Gallons in Well | 0.93 |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | 17.5 |
| Purge Time | begin 1603 end 1643 |
| Pumping Rate (ml/min) | 300 |
| Evacuation Method | peristaltic |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | peristaltic |
| Remarks | PVC casing stainless steel screen |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS 537 mod DoD QSM Table B-15 | 250ml poly | 4 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Duplicate sample collected

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | |
|---|---|---|---|---|
| 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

# YSI/LOW FLOW SAMPLING LOG



WELL : MW-VRTB-3 PROJ #: 30027244

DATE : 12/27/2021 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1603 | pump on | | | | | | | | | 13.79 |
| 1606 | | | | | | | | 300 | 81.3 | 13.80 |
| 1609 | 10.2 | 0.327 | 0.235 | 70.0 | 7.91 | 7.95 | -4.2 | | 38.4 | |
| 1612 | 10.1 | 0.332 | 0.239 | 70.8 | 7.95 | 7.93 | -0.9 | | 19.9 | 13.80 |
| 1615 | 10.2 | 0.334 | 0.240 | 71.3 | 8.02 | 7.93 | 0.3 | | 13.4 | |
| 1618 | 10.1 | 0.335 | 0.240 | 71.5 | 8.03 | 7.92 | 1.9 | | 10.6 | 13.80 |
| 1621 | 10.2 | 0.333 | 0.239 | 72.2 | 8.09 | 7.91 | 3.3 | | 6.89 | |
| 1624 | 10.2 | 0.331 | 0.238 | 72.4 | 8.14 | 7.91 | 4.0 | | 9.22 | 13.80 |
| 1627 | 10.2 | 0.334 | 0.240 | 73.1 | 8.18 | 7.90 | 5.2 | | 5.55 | |
| 1630 | 10.3 | 0.332 | 0.239 | 72.5 | 8.10 | 7.89 | 7.8 | | 4.50 | 13.80 |
| 1633 | 10.1 | 0.334 | 0.238 | 72.7 | 8.19 | 7.90 | 7.1 | ↓ | 3.68 | |
| 1636 | 10.3 | 0.334 | 0.240 | 71.5 | 8.00 | 7.89 | 8.2 | 300 | 3.16 | 13.80 |
| 1639 | Collected sample | | | MW-VRTB-3_12272021 and Dup-02_12272021 | | | | | | |

| | |
|---|---|
| Total Depth of Well: | 19.58 |
| Depth To Water Before Purging: | 13.79 |
| Depth To Water After Purging: | 13.80 |

3 min interval based on flow through rate

# Groundwater Sampling Logs

# Performance Monitoring Event #2

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_1 | | | **Date** | 04/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 33.8 degrees F and Mostly Cloudy. The wind is blowing W/SW at 12.8 mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 14.51 | **Total Depth (ft-bmp)** | 15 | **Water Column (ft)** | 0.49 | **Gallons in Well** | |
| **Purge Start** | 11:30 | **Pump Intake (ft-bmp)** | 15 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:55 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_1_04152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:50 | **Gallons Purged** | 1.06 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:35 | 0 | 0 | 200 | 14.51 | 0.26 | 8.23 | 0.066 | 4.83 | 12.57 | 6.7 | 267.8 | -- | -- |
| 11:40 | 5 | 5 | 200 | 14.51 | 0.53 | 8.23 | 0.067 | 2.21 | 12.63 | 6.6 | 269.8 | -- | -- |
| 11:45 | 5 | 10 | 200 | 14.51 | 0.79 | 8.19 | 0.068 | 1.91 | 13.08 | 6.7 | 275.1 | -- | -- |
| 11:50 | 5 | 15 | 200 | 14.51 | 1.06 | 8.17 | 0.069 | 1.72 | 13.15 | 6.6 | 277.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_2 | | | **Date** | 04/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 33.8 degrees F and Mostly Cloudy. The wind is blowing W/SW at 12.8 mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 14.51 | **Total Depth (ft-bmp)** | 17 | **Water Column (ft)** | 2.49 | **Gallons in Well** | |
| **Purge Start** | 10:55 | **Pump Intake (ft-bmp)** | 17 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:25 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_2_04152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:20 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:00 | 0 | 0 | 200 | 14.51 | 0.26 | 7.25 | 0.239 | 5.44 | 2.05 | 7 | 282.8 | -- | -- |
| 11:05 | 5 | 5 | 200 | 14.51 | 0.53 | 7.25 | 0.236 | 4.93 | 2.17 | 7 | 279.9 | -- | -- |
| 11:10 | 5 | 10 | 200 | 14.51 | 0.79 | 7.26 | 0.232 | 3.67 | 2.54 | 7 | 275.2 | -- | -- |
| 11:15 | 5 | 15 | 200 | 14.51 | 1.06 | 7.26 | 0.23 | 3.55 | 2.56 | 7 | 274.2 | -- | -- |
| 11:20 | 5 | 20 | 200 | 14.51 | 1.32 | 7.26 | 0.228 | 3.47 | 2.63 | 7 | 272.6 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_3 | | | **Date** | 04/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 44.6 degrees F and Mostly Cloudy and Windy. The wind is blowing SW at 21.9 mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 14.51 | **Total Depth (ft-bmp)** | 19.5 | **Water Column (ft)** | 4.99 | **Gallons in Well** | |
| **Purge Start** | 10:20 | **Pump Intake (ft-bmp)** | 19.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:50 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_3_04152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:45 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:25 | 0 | 0 | 200 | 14.51 | 0.26 | 7.32 | 0.236 | 5.13 | 10.43 | 7.6 | 282.1 | -- | -- |
| 10:30 | 5 | 5 | 200 | 14.51 | 0.53 | 7.33 | 0.238 | 2.28 | 11.74 | 7.6 | 286.4 | -- | -- |
| 10:35 | 5 | 10 | 200 | 14.51 | 0.79 | 7.33 | 0.238 | 2.02 | 11.7 | 7.6 | 291.1 | -- | -- |
| 10:40 | 5 | 15 | 200 | 14.51 | 1.06 | 7.34 | 0.238 | 1.41 | 11.52 | 7.6 | 293.5 | -- | -- |
| 10:45 | 5 | 20 | 200 | 14.51 | 1.32 | 7.34 | 0.238 | 1.21 | 11.53 | 7.7 | 297.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_4 | | | **Date** | 04/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 44.6 degrees F and Mostly Cloudy and Windy. The wind is blowing SW at 21.9 mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 14.51 | **Total Depth (ft-bmp)** | 23 | **Water Column (ft)** | 8.49 | **Gallons in Well** | |
| **Purge Start** | 09:50 | **Pump Intake (ft-bmp)** | 23 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:20 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_4_04152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:15 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:55 | 0 | 0 | 200 | 14.51 | 0.26 | 7.3 | 0.234 | 2.69 | 10.21 | 8 | 284 | -- | -- |
| 10:00 | 5 | 5 | 200 | 14.51 | 0.53 | 7.33 | 0.234 | 2.11 | 11.18 | 8.3 | 288.7 | -- | -- |
| 10:05 | 5 | 10 | 200 | 14.51 | 0.79 | 7.33 | 0.234 | 1.84 | 10.97 | 8.3 | 291.6 | -- | -- |
| 10:10 | 5 | 15 | 200 | 14.51 | 1.06 | 7.34 | 0.233 | 1.8 | 11.36 | 8.3 | 293.3 | -- | -- |
| 10:15 | 5 | 20 | 200 | 14.51 | 1.32 | 7.34 | 0.233 | 1.32 | 11.16 | 8.3 | 294.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

| | |
|---|---|
| Well diameter (inches) = gallons per foot | 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47<br>1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65 |

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_5 | | | **Date** | 04/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 44.6 degrees F and Mostly Cloudy and Windy. The wind is blowing SW at 21.9 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 14.51 | **Total Depth (ft-bmp)** | 26.5 | **Water Column (ft)** | 11.99 | **Gallons in Well** | |
| **Purge Start** | 09:15 | **Pump Intake (ft-bmp)** | 26.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:40 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_5_04152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:35 | **Gallons Purged** | 1.06 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:20 | 0 | 0 | 200 | 14.51 | 0.26 | 7.32 | 0.213 | 4.32 | 10.97 | 8 | 282.9 | -- | -- |
| 09:25 | 5 | 5 | 200 | 14.51 | 0.53 | 7.34 | 0.213 | 2.61 | 11.15 | 8.1 | 286.9 | -- | -- |
| 09:30 | 5 | 10 | 200 | 14.51 | 0.79 | 7.35 | 0.214 | 2.02 | 11 | 8.2 | 288.8 | -- | -- |
| 09:35 | 5 | 15 | 200 | 14.51 | 1.06 | 7.36 | 0.213 | 1.62 | 11.32 | 8.1 | 291.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_6 | | | **Date** | 04/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 44.6 degrees F and Mostly Cloudy and Windy. The wind is blowing SW at 21.9 mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 14.51 | **Total Depth (ft-bmp)** | 30.5 | **Water Column (ft)** | 15.99 | **Gallons in Well** | |
| **Purge Start** | 08:40 | **Pump Intake (ft-bmp)** | 30.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:10 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_6_04152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:05 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:45 | 0 | 0 | 200 | 14.51 | 0.26 | 7.33 | 0.171 | 2.76 | 10.36 | 8.4 | 289.2 | -- | -- |
| 08:50 | 5 | 5 | 200 | 14.51 | 0.53 | 7.42 | 0.173 | 2.51 | 10.89 | 8.6 | 289.6 | -- | -- |
| 08:55 | 5 | 10 | 200 | 14.51 | 0.79 | 7.46 | 0.172 | 2.19 | 10.86 | 8.5 | 290.4 | -- | -- |
| 09:00 | 5 | 15 | 200 | 14.51 | 1.06 | 7.49 | 0.173 | 1.85 | 11.25 | 8.6 | 291.4 | -- | -- |
| 09:05 | 5 | 20 | 200 | 14.51 | 1.32 | 7.5 | 0.172 | 1.63 | 11.58 | 8.6 | 291.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

| | |
|---|---|
| Well diameter (inches) = gallons per foot | 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47<br>1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65 |

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_7 | | | **Date** | 04/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 44.6 degrees F and Mostly Cloudy and Windy. The wind is blowing SW at 21.9 mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 14.51 | **Total Depth (ft-bmp)** | 36.5 | **Water Column (ft)** | 21.99 | **Gallons in Well** | |
| **Purge Start** | 07:55 | **Pump Intake (ft-bmp)** | 36.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 08:25 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_7_04152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 08:20 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | MS/MSD | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:00 | 0 | 0 | 200 | 14.51 | 0.26 | 7.84 | 0.111 | 4.3 | 10.15 | 8.9 | 261 | -- | -- |
| 08:05 | 5 | 5 | 200 | 14.51 | 0.53 | 7.81 | 0.112 | 2.11 | 10.29 | 8.9 | 261.8 | -- | -- |
| 08:10 | 5 | 10 | 200 | 14.51 | 0.79 | 7.76 | 0.112 | 1.64 | 10.15 | 8.9 | 263.6 | -- | -- |
| 08:15 | 5 | 15 | 200 | 14.51 | 1.06 | 7.73 | 0.112 | 1.31 | 10.33 | 8.9 | 266 | -- | -- |
| 08:20 | 5 | 20 | 200 | 14.51 | 1.32 | 7.7 | 0.112 | 1.14 | 9.64 | 9.1 | 270.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS Top Assay | 250mL HDPE Plastic | 6 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-1D | | | **Date** | 04/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 64.4 degrees F and Cloudy. The wind is blowing SW at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 13.02 | **Total Depth (ft-bmp)** | 30.28 | **Water Column (ft)** | 17.26 | **Gallons in Well** | 2.8 |
| **Purge Start** | 15:40 | **Pump Intake (ft-bmp)** | 27.78 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:30 | **Volumes Purged** | 1.70 | **Sample ID** | MW-VRTB-1D_04132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:25 | **Gallons Purged** | 4.76 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:45 | 0 | 0 | 400 | 13.02 | 0.53 | 7.69 | 0.19 | 15.53 | 9.62 | 9.9 | 261.4 | -- | -- |
| 15:50 | 5 | 5 | 400 | 13.02 | 1.06 | 7.64 | 0.191 | 9.99 | 9.62 | 9.8 | 269.9 | -- | -- |
| 15:55 | 5 | 10 | 400 | 13.02 | 1.59 | 7.65 | 0.184 | 7.54 | 9.6 | 9.9 | 272.1 | -- | -- |
| 16:00 | 5 | 15 | 400 | 13.02 | 2.11 | 7.64 | 0.187 | 5.58 | 9.63 | 9.8 | 278.3 | -- | -- |
| 16:05 | 5 | 20 | 400 | 13.02 | 2.64 | 7.63 | 0.184 | 4.41 | 9.64 | 9.8 | 279.8 | -- | -- |
| 16:10 | 5 | 25 | 400 | 13.02 | 3.17 | 7.61 | 0.186 | 4.11 | 9.61 | 10 | 284 | -- | -- |
| 16:15 | 5 | 30 | 400 | 13.02 | 3.70 | 7.61 | 0.183 | 3.63 | 9.68 | 9.8 | 286.6 | -- | -- |
| 16:20 | 5 | 35 | 400 | 13.02 | 4.23 | 7.61 | 0.185 | 3.27 | 9.64 | 9.9 | 288.3 | -- | -- |
| 16:25 | 5 | 40 | 400 | 13.02 | 4.76 | 7.62 | 0.183 | 3.01 | 9.63 | 10 | 288.8 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-1S | | | **Date** | 04/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 64.4 degrees F and Cloudy. The wind is blowing SW at 9.2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 12.66 | **Total Depth (ft-bmp)** | 19.47 | **Water Column (ft)** | 6.81 | **Gallons in Well** | 1.11 |
| **Purge Start** | 14:25 | **Pump Intake (ft-bmp)** | 16.97 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:20 | **Volumes Purged** | 4.76 | **Sample ID** | MW-VRTB-1S_04132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:15 | **Gallons Purged** | 5.28 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:30 | 0 | 0 | 400 | 12.66 | 0.53 | 7.31 | 0.241 | 5.8 | 5.36 | 8.8 | 269.7 | -- | -- |
| 14:35 | 5 | 5 | 400 | 12.66 | 1.06 | 7.27 | 0.241 | 10.12 | 4.94 | 8.8 | 240 | -- | -- |
| 14:40 | 5 | 10 | 400 | 12.66 | 1.59 | 7.24 | 0.243 | 10.61 | 4.86 | 9.2 | 207.6 | -- | -- |
| 14:45 | 5 | 15 | 400 | 12.66 | 2.11 | 7.23 | 0.242 | 9.53 | 4.67 | 9.1 | 183 | -- | -- |
| 14:50 | 5 | 20 | 400 | 12.66 | 2.64 | 7.23 | 0.242 | 7.61 | 4.7 | 9 | 178.1 | -- | -- |
| 14:55 | 5 | 25 | 400 | 12.66 | 3.17 | 7.23 | 0.242 | 4.33 | 4.73 | 9 | 177.3 | -- | -- |
| 15:00 | 5 | 30 | 400 | 12.66 | 3.70 | 7.23 | 0.242 | 2.81 | 4.86 | 8.9 | 172.1 | -- | -- |
| 15:05 | 5 | 35 | 400 | 12.66 | 4.23 | 7.25 | 0.24 | 2.14 | 5.13 | 8.7 | 172.4 | -- | -- |
| 15:10 | 5 | 40 | 400 | 12.66 | 4.76 | 7.25 | 0.24 | 2.34 | 4.98 | 8.8 | 172.2 | -- | -- |
| 15:15 | 5 | 45 | 400 | 12.66 | 5.28 | 7.25 | 0.239 | 2.02 | 5.19 | 8.7 | 175.6 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-2D | | | **Date** | 04/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 64.4 degrees F and Cloudy. The wind is blowing SW at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 13.00 | **Total Depth (ft-bmp)** | 30.4 | **Water Column (ft)** | 17.4 | **Gallons in Well** | 2.83 |
| **Purge Start** | 13:10 | **Pump Intake (ft-bmp)** | 27.9 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:55 | **Volumes Purged** | 1.49 | **Sample ID** | MW-VRTB-2D_04132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:50 | **Gallons Purged** | 4.23 | **Replicate/ Code No.** | Dup-01_04132022 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:15 | 0 | 0 | 400 | 13.00 | 0.53 | 7.38 | 0.237 | 35.63 | 9.29 | 10 | 280 | -- | -- |
| 13:20 | 5 | 5 | 400 | 13.00 | 1.06 | 7.38 | 0.242 | 7.29 | 9.07 | 10.3 | 282.2 | -- | -- |
| 13:25 | 5 | 10 | 400 | 13.00 | 1.59 | 7.39 | 0.243 | 3.59 | 9.01 | 10.3 | 282.4 | -- | -- |
| 13:30 | 5 | 15 | 400 | 13.00 | 2.11 | 7.38 | 0.244 | 3.11 | 8.93 | 10.4 | 282.4 | -- | -- |
| 13:35 | 5 | 20 | 400 | 13.00 | 2.64 | 7.38 | 0.243 | 2.69 | 8.99 | 10.5 | 282.3 | -- | -- |
| 13:40 | 5 | 25 | 400 | 13.00 | 3.17 | 7.39 | 0.244 | 1.77 | 8.98 | 10.3 | 281.8 | -- | -- |
| 13:45 | 5 | 30 | 400 | 13.00 | 3.70 | 7.4 | 0.245 | 1.51 | 8.96 | 10.2 | 280.1 | -- | -- |
| 13:50 | 5 | 35 | 400 | 13.00 | 4.23 | 7.41 | 0.246 | 1.22 | 9.12 | 10.2 | 276.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 4 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-2S | | | **Date** | 04/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 64.4 degrees F and Cloudy. The wind is blowing SW at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 13.04 | **Total Depth (ft-bmp)** | 20.49 | **Water Column (ft)** | 7.45 | **Gallons in Well** | 1.21 |
| **Purge Start** | 12:15 | **Pump Intake (ft-bmp)** | 17.99 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:00 | **Volumes Purged** | 3.49 | **Sample ID** | MW-VRTB-2S_04132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:55 | **Gallons Purged** | 4.23 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:20 | 0 | 0 | 400 | 13.04 | 0.53 | 7.15 | 0.26 | 23.27 | 3.65 | 8.7 | 285.9 | -- | -- |
| 12:25 | 5 | 5 | 400 | 13.04 | 1.06 | 7.12 | 0.262 | 10.67 | 3.61 | 9.1 | 283.6 | -- | -- |
| 12:30 | 5 | 10 | 400 | 13.04 | 1.59 | 7.12 | 0.261 | 13.24 | 3.64 | 9 | 283 | -- | -- |
| 12:35 | 5 | 15 | 400 | 13.04 | 2.11 | 7.13 | 0.26 | 22.51 | 3.74 | 9.1 | 279.3 | -- | -- |
| 12:40 | 5 | 20 | 400 | 13.04 | 2.64 | 7.14 | 0.259 | 26.32 | 3.76 | 9 | 277.9 | -- | -- |
| 12:45 | 5 | 25 | 400 | 13.04 | 3.17 | 7.15 | 0.259 | 36.06 | 3.74 | 9.2 | 276.6 | -- | -- |
| 12:50 | 5 | 30 | 400 | 13.04 | 3.70 | 7.15 | 0.259 | 34.37 | 3.71 | 9.1 | 276 | -- | -- |
| 12:55 | 5 | 35 | 400 | 13.04 | 4.23 | 7.17 | 0.257 | 34.11 | 3.7 | 9.2 | 275.1 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-3 | | | **Date** | 04/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 12.76 | **Total Depth (ft-bmp)** | 19.54 | **Water Column (ft)** | 6.78 | **Gallons in Well** | 1.1 |
| **Purge Start** | 10:55 | **Pump Intake (ft-bmp)** | 17.04 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | | **Volumes Purged** | 3.36 | **Sample ID** | MW-VRTB-3_04132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:30 | **Gallons Purged** | 3.70 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:00 | 0 | 0 | 400 | 12.76 | 0.53 | 7.42 | 0.279 | 12.16 | 10.28 | 8.4 | 259.7 | -- | -- |
| 11:05 | 5 | 5 | 400 | 12.76 | 1.06 | 7.38 | 0.281 | 13.87 | 10.26 | 8.4 | 264 | -- | -- |
| 11:10 | 5 | 10 | 400 | 12.76 | 1.59 | 7.36 | 0.28 | 13.64 | 10.3 | 8.4 | 265.7 | -- | -- |
| 11:15 | 5 | 15 | 400 | 12.76 | 2.11 | 7.36 | 0.282 | 13.65 | 10.26 | 8.5 | 268.4 | -- | -- |
| 11:20 | 5 | 20 | 400 | 12.76 | 2.64 | 7.35 | 0.28 | 14.17 | 10.25 | 8.5 | 271.5 | -- | -- |
| 11:25 | 5 | 25 | 400 | 12.76 | 3.17 | 7.35 | 0.279 | 14.85 | 10.18 | 8.6 | 273.3 | -- | -- |
| 11:30 | 5 | 30 | 400 | 12.76 | 3.70 | 7.35 | 0.278 | 15.61 | 10.19 | 8.7 | 274.3 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-B1 | | | **Date** | 04/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 41.0 degrees F and Partly Cloudy and Windy. The wind is blowing SW at 20.8 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 12:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:30 | **Volumes Purged** | | **Sample ID** | VRTB-L-B1_04142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:25 | **Gallons Purged** | 7.40 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:20 | 0 | 0 | 400 | 0.00 | 0.53 | 7.24 | 1.495 | 314.73 | 0.44 | 7.6 | 59.7 | -- | -- |
| 12:25 | 5 | 5 | 400 | 0.00 | 1.06 | 7.6 | 1.361 | 110.91 | 0.25 | 7.8 | -10.7 | -- | -- |
| 12:30 | 5 | 10 | 400 | 0.00 | 1.59 | 8.53 | 1.225 | 77.94 | 0.13 | 7.9 | -195.6 | -- | -- |
| 12:35 | 5 | 15 | 400 | 0.00 | 2.11 | 8.85 | 1.182 | 50.11 | 0.06 | 7.9 | -261.8 | -- | -- |
| 12:40 | 5 | 20 | 400 | 0.00 | 2.64 | 8.92 | 1.123 | 43.86 | 0.02 | 7.9 | -290.1 | -- | -- |
| 12:45 | 5 | 25 | 400 | 0.00 | 3.17 | 8.96 | 1.096 | 35.2 | 0.01 | 7.9 | -303.4 | -- | -- |
| 12:50 | 5 | 30 | 400 | 0.00 | 3.70 | 8.92 | 1.071 | 26.63 | 0 | 7.9 | -305.6 | -- | -- |
| 12:55 | 5 | 35 | 400 | 0.00 | 4.23 | 8.89 | 1.035 | 22.65 | 0 | 7.9 | -306.7 | -- | -- |
| 13:00 | 5 | 40 | 400 | 0.00 | 4.76 | 8.87 | 1.001 | 16.64 | 0 | 7.7 | -307.3 | -- | -- |
| 13:05 | 5 | 45 | 400 | 0.00 | 5.28 | 8.85 | 0.98 | 13.32 | -0.02 | 7.8 | -308.5 | -- | -- |
| 13:10 | 5 | 50 | 400 | 0.00 | 5.81 | 8.81 | 0.963 | 12.66 | -0.03 | 7.6 | -309.6 | -- | -- |
| 13:15 | 5 | 55 | 400 | 0.00 | 6.34 | 8.79 | 0.929 | 12.03 | -0.03 | 7.7 | -309.3 | -- | -- |
| 13:20 | 5 | 60 | 400 | 0.00 | 6.87 | 8.78 | 0.925 | 11.69 | -0.03 | 7.7 | -309 | -- | -- |
| 13:25 | 5 | 65 | 400 | 0.00 | 7.40 | 8.76 | 0.91 | 10.95 | -0.03 | 7.9 | -307.8 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Well Locked at Arrival: no
Condition of Well: Good condition
Well Locked at Departure: no
Well Completion: Flush mount
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-BB8 | | | **Date** | 04/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 37.4 degrees F and Clear. The wind is blowing W/SW at 18.3 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 10:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:25 | **Volumes Purged** | | **Sample ID** | VRTB-L-BB8_04142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:20 | **Gallons Purged** | 4.23 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:45 | 0 | 0 | 400 | 0.00 | 0.53 | 7.32 | 0.454 | 7.25 | 0.3 | 7.4 | -55.6 | -- | -- |
| 10:50 | 5 | 5 | 400 | 0.00 | 1.06 | 7.31 | 0.444 | 6.47 | 0.29 | 7.5 | -59.1 | -- | -- |
| 10:55 | 5 | 10 | 400 | 0.00 | 1.59 | 7.3 | 0.43 | 5.53 | 0.26 | 7.5 | -62.6 | -- | -- |
| 11:00 | 5 | 15 | 400 | 0.00 | 2.11 | 7.29 | 0.423 | 3.75 | 0.26 | 7.6 | -64.2 | -- | -- |
| 11:05 | 5 | 20 | 400 | 0.00 | 2.64 | 7.28 | 0.419 | 3.61 | 0.25 | 7.6 | -65 | -- | -- |
| 11:10 | 5 | 25 | 400 | 0.00 | 3.17 | 7.27 | 0.415 | 3.12 | 0.25 | 7.7 | -65.6 | -- | -- |
| 11:15 | 5 | 30 | 400 | 0.00 | 3.70 | 7.25 | 0.412 | 2.51 | 0.25 | 7.7 | -65.5 | -- | -- |
| 11:20 | 5 | 35 | 400 | 0.00 | 4.23 | 7.24 | 0.411 | 2.21 | 0.24 | 7.8 | -65.3 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-G4 | | | **Date** | 04/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 44.6 degrees F and Mostly Cloudy and Windy. The wind is blowing SW at 21.9 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 15:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:35 | **Volumes Purged** | | **Sample ID** | VRTB-L-G4_04142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:30 | **Gallons Purged** | 4.76 | **Replicate/ Code No.** | Dup-02_04142022 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:50 | 0 | 0 | 400 | 0.00 | 0.53 | 6.82 | 0.368 | 5.69 | 2.22 | 7.6 | 105.9 | -- | -- |
| 15:55 | 5 | 5 | 400 | 0.00 | 1.06 | 7.06 | 0.322 | 3.93 | 1.75 | 7.6 | 88.7 | -- | -- |
| 16:00 | 5 | 10 | 400 | 0.00 | 1.59 | 7.08 | 0.314 | 3.11 | 2.13 | 7.5 | 87.6 | -- | -- |
| 16:05 | 5 | 15 | 400 | 0.00 | 2.11 | 7.07 | 0.31 | 2.35 | 2.38 | 7.5 | 91.6 | -- | -- |
| 16:10 | 5 | 20 | 400 | 0.00 | 2.64 | 7.07 | 0.305 | 2.21 | 2.61 | 7.4 | 98.3 | -- | -- |
| 16:15 | 5 | 25 | 400 | 0.00 | 3.17 | 7.06 | 0.304 | 1.81 | 2.64 | 7.5 | 101 | -- | -- |
| 16:20 | 5 | 30 | 400 | 0.00 | 3.70 | 7.06 | 0.302 | 1.45 | 2.69 | 7.5 | 107.5 | -- | -- |
| 16:25 | 5 | 35 | 400 | 0.00 | 4.23 | 7.06 | 0.301 | 1.79 | 2.7 | 7.4 | 109.9 | -- | -- |
| 16:30 | 5 | 40 | 400 | 0.00 | 4.76 | 7.05 | 0.303 | 1.54 | 2.71 | 7.4 | 114.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-M5 | | | **Date** | 04/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 64.4 degrees F and Cloudy. The wind is blowing SW at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 17:00 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:50 | **Volumes Purged** | | **Sample ID** | VRTB-L-M5_04132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:45 | **Gallons Purged** | 4.76 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:35 | 0 | 0 | 400 | | 3.70 | 6.98 | 0.566 | 2.55 | 0.06 | 8.6 | -37.4 | -- | -- |
| 17:40 | 5 | 5 | 400 | | 4.23 | 6.98 | 0.56 | 2.14 | 0.06 | 8.5 | -38.6 | -- | -- |
| 17:45 | 5 | 10 | 400 | | 4.76 | 6.98 | 0.552 | 1.94 | 0.06 | 8.5 | -40.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:** The first 35 minutes of parameter readings were lost due to tablet malfunction.

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-O6 | | | **Date** | 04/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 32.0 degrees F and Partly Cloudy. The wind is blowing W at 16.1 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 08:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:05 | **Volumes Purged** | | **Sample ID** | VRTB-L-O6_04142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:00 | **Gallons Purged** | 4.76 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:20 | 0 | 0 | 400 | 0.00 | 0.53 | 6.74 | 0.4 | 13.41 | 0.53 | 7.1 | 74.7 | -- | -- |
| 08:25 | 5 | 5 | 400 | 0.00 | 1.06 | 6.74 | 0.393 | 11.22 | 0.52 | 7.1 | 67.1 | -- | -- |
| 08:30 | 5 | 10 | 400 | 0.00 | 1.59 | 6.75 | 0.377 | 8.44 | 0.48 | 7.2 | 52.1 | -- | -- |
| 08:35 | 5 | 15 | 400 | 0.00 | 2.11 | 6.76 | 0.367 | 5.31 | 0.46 | 7.2 | 39.7 | -- | -- |
| 08:40 | 5 | 20 | 400 | 0.00 | 2.64 | 6.79 | 0.357 | 3.39 | 0.45 | 7.3 | 29.3 | -- | -- |
| 08:45 | 5 | 25 | 400 | 0.00 | 3.17 | 6.77 | 0.351 | 2.41 | 0.46 | 7.2 | 21.9 | -- | -- |
| 08:50 | 5 | 30 | 400 | 0.00 | 3.70 | 6.8 | 0.346 | 2.22 | 0.53 | 7.2 | 17.2 | -- | -- |
| 08:55 | 5 | 35 | 400 | 0.00 | 4.23 | 6.79 | 0.344 | 2.01 | 0.54 | 7.2 | 16.5 | -- | -- |
| 09:00 | 5 | 40 | 400 | 0.00 | 4.76 | 6.8 | 0.342 | 1.77 | 0.52 | 7.3 | 11.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-P7 | | | **Date** | 04/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 33.8 degrees F and Clear. The wind is blowing W at 12.8 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 09:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:25 | **Volumes Purged** | | **Sample ID** | VRTB-L-P7_04142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:20 | **Gallons Purged** | 6.87 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:20 | 0 | 0 | 400 | 0.00 | 0.53 | 6.35 | 2.433 | 9.83 | 0.14 | 7.5 | 11.5 | -- | -- |
| 09:25 | 5 | 5 | 400 | 0.00 | 1.06 | 6.43 | 2.3 | 4.48 | 0.07 | 7.5 | -3.1 | -- | -- |
| 09:30 | 5 | 10 | 400 | 0.00 | 1.59 | 6.46 | 2.242 | 3.19 | 0.04 | 7.5 | -8.4 | -- | -- |
| 09:35 | 5 | 15 | 400 | 0.00 | 2.11 | 6.52 | 2.065 | 2.93 | 0.01 | 7.6 | -18.1 | -- | -- |
| 09:40 | 5 | 20 | 400 | 0.00 | 2.64 | 6.54 | 2.002 | 2.44 | 0 | 7.6 | -20.9 | -- | -- |
| 09:45 | 5 | 25 | 400 | 0.00 | 3.17 | 6.57 | 1.902 | 2.97 | -0.01 | 7.6 | -25.6 | -- | -- |
| 09:50 | 5 | 30 | 400 | 0.00 | 3.70 | 6.6 | 1.795 | 2.17 | -0.01 | 7.6 | -30.2 | -- | -- |
| 09:55 | 5 | 35 | 400 | 0.00 | 4.23 | 6.63 | 1.739 | 1.84 | -0.02 | 7.7 | -33.9 | -- | -- |
| 10:00 | 5 | 40 | 400 | 0.00 | 4.76 | 6.66 | 1.646 | 1.51 | -0.02 | 7.7 | -38.7 | -- | -- |
| 10:05 | 5 | 45 | 400 | 0.00 | 5.28 | 6.69 | 1.565 | 1.08 | -0.02 | 7.8 | -42.3 | -- | -- |
| 10:10 | 5 | 50 | 400 | 0.00 | 5.81 | 6.7 | 1.566 | 2.92 | -0.02 | 7.8 | -43.5 | -- | -- |
| 10:15 | 5 | 55 | 400 | 0.00 | 6.34 | 6.7 | 1.552 | 2.11 | -0.02 | 7.7 | -46.2 | -- | -- |
| 10:20 | 5 | 60 | 400 | 0.00 | 6.87 | 6.73 | 1.524 | 1.96 | -0.02 | 7.7 | -47.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-S2 | | | **Date** | 04/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 44.6 degrees F and Partly Cloudy and Windy. The wind is blowing W/SW at 20.8 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 13:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:50 | **Volumes Purged** | | **Sample ID** | VRTB-L-S2_04142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:45 | **Gallons Purged** | 6.87 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:45 | 0 | 0 | 400 | 0.00 | 0.53 | 7.19 | 2.242 | 76.67 | 0.25 | 7.8 | -61.9 | -- | -- |
| 13:50 | 5 | 5 | 400 | 0.00 | 1.06 | 7.18 | 2.235 | 30.94 | 0.14 | 7.9 | -77.3 | -- | -- |
| 13:55 | 5 | 10 | 400 | 0.00 | 1.59 | 7.19 | 2.009 | 12.23 | 0.09 | 7.8 | -87 | -- | -- |
| 14:00 | 5 | 15 | 400 | 0.00 | 2.11 | 7.13 | 1.86 | 7.88 | 0.07 | 8 | -88.1 | -- | -- |
| 14:05 | 5 | 20 | 400 | 0.00 | 2.64 | 7.13 | 1.73 | 3.27 | 0.04 | 7.8 | -89 | -- | -- |
| 14:10 | 5 | 25 | 400 | 0.00 | 3.17 | 7.06 | 1.608 | 2.48 | 0.02 | 7.8 | -90.6 | -- | -- |
| 14:15 | 5 | 30 | 400 | 0.00 | 3.70 | 7.04 | 1.52 | 2.09 | 0.02 | 7.7 | -91.1 | -- | -- |
| 14:20 | 5 | 35 | 400 | 0.00 | 4.23 | 7.05 | 1.407 | 1.94 | 0.02 | 7.7 | -93.6 | -- | -- |
| 14:25 | 5 | 40 | 400 | 0.00 | 4.76 | 7.06 | 1.341 | 1.55 | 0.02 | 7.8 | -94.7 | -- | -- |
| 14:30 | 5 | 45 | 400 | 0.00 | 5.28 | 7.07 | 1.26 | 1.31 | 0.02 | 7.9 | -96.3 | -- | -- |
| 14:35 | 5 | 50 | 400 | 0.00 | 5.81 | 7.09 | 1.209 | 1.56 | 0.02 | 7.8 | -97.9 | -- | -- |
| 14:40 | 5 | 55 | 400 | 0.00 | 6.34 | 7.09 | 1.189 | 1.35 | 0.02 | 7.7 | -98.4 | -- | -- |
| 14:45 | 5 | 60 | 400 | 0.00 | 6.87 | 7.11 | 1.18 | 1.35 | 0.02 | 7.7 | -98.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-Y3 | | | **Date** | 04/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 44.6 degrees F and Mostly Cloudy and Windy. The wind is blowing SW at 21.9 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 14:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:35 | **Volumes Purged** | | **Sample ID** | VRTB-L-Y3_04142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:30 | **Gallons Purged** | 3.70 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:00 | 0 | 0 | 400 | 0.00 | 0.53 | 6.44 | 0.513 | 6.63 | 3.82 | 7.4 | 55 | -- | -- |
| 15:05 | 5 | 5 | 400 | 0.00 | 1.06 | 7.13 | 0.278 | 3.49 | 1.01 | 7.5 | 17 | -- | -- |
| 15:10 | 5 | 10 | 400 | 0.00 | 1.59 | 7.29 | 0.24 | 2.39 | 0.81 | 7.5 | 4.4 | -- | -- |
| 15:15 | 5 | 15 | 400 | 0.00 | 2.11 | 7.3 | 0.38 | 2.1 | 0.82 | 7.5 | 1.6 | -- | -- |
| 15:20 | 5 | 20 | 400 | 0.00 | 2.64 | 7.31 | 0.236 | 1.89 | 0.89 | 7.6 | 0.2 | -- | -- |
| 15:25 | 5 | 25 | 400 | 0.00 | 3.17 | 7.31 | 0.233 | 1.57 | 0.89 | 7.5 | 1.2 | -- | -- |
| 15:30 | 5 | 30 | 400 | 0.00 | 3.70 | 7.31 | 0.232 | 1.41 | 0.89 | 7.4 | 2.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-M5 | | | **Date** | 04/19/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 30.2 degrees F and Cloudy. The wind is blowing N/NW at 11.4 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 09:30 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:44 | **Volumes Purged** | | **Sample ID** | VRTB-S-M5_04192022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:25 | **Gallons Purged** | 5.81 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:50 | 0 | 0 | 400 | 0.00 | 2.11 | 7.65 | 0.741 | 96.91 | 3.66 | 5.4 | 230.5 | -- | -- |
| 09:55 | 5 | 5 | 400 | 0.00 | 2.64 | 7.61 | 0.681 | 55.79 | 3.52 | 5.3 | 231.2 | -- | -- |
| 10:00 | 5 | 10 | 400 | 0.00 | 3.17 | 7.61 | 0.647 | 46.08 | 3.42 | 5.4 | 231.6 | -- | -- |
| 10:05 | 5 | 15 | 400 | 0.00 | 3.70 | 7.62 | 0.601 | 35.12 | 3.51 | 5.5 | 233.7 | -- | -- |
| 10:10 | 5 | 20 | 400 | 0.00 | 4.23 | 7.62 | 0.548 | 32.87 | 3.51 | 5.5 | 235 | -- | -- |
| 10:15 | 5 | 25 | 400 | 0.00 | 4.76 | 7.62 | 0.567 | 26.71 | 3.69 | 5.5 | 236.6 | -- | -- |
| 10:20 | 5 | 30 | 400 | 0.00 | 5.28 | 7.63 | 0.556 | 25.68 | 3.73 | 5.5 | 237.8 | -- | -- |
| 10:25 | 5 | 35 | 400 | 0.00 | 5.81 | 7.63 | 0.551 | 25.01 | 3.85 | 5.6 | 239.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |
| Total Organic Carbon | 250mL HDPE Plastic | 1 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-P8 | | | **Date** | 04/19/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 30.2 degrees F and Cloudy. The wind is blowing N/NW at 11.4 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 10:50 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:00 | **Volumes Purged** | | **Sample ID** | VRTB-S-P8_04192022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:55 | **Gallons Purged** | 6.87 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:55 | 0 | 0 | 400 | 0.00 | 0.53 | 11.69 | 1.262 | 47.08 | 13.01 | 5.4 | 211.6 | -- | -- |
| 11:00 | 5 | 5 | 400 | 0.00 | 1.06 | 11.67 | 1.038 | 32.39 | 11.81 | 5.5 | 205.7 | -- | -- |
| 11:05 | 5 | 10 | 400 | 0.00 | 1.59 | 11.34 | 0.608 | 36.15 | 10.69 | 5.7 | 203.2 | -- | -- |
| 11:10 | 5 | 15 | 400 | 0.00 | 2.11 | 11.03 | 0.403 | 31.15 | 10.69 | 5.7 | 206.7 | -- | -- |
| 11:15 | 5 | 20 | 400 | 0.00 | 2.64 | 10.94 | 0.41 | 26.19 | 10.23 | 5.8 | 209.1 | -- | -- |
| 11:20 | 5 | 25 | 400 | 0.00 | 3.17 | 10.64 | 0.358 | 27.35 | 10.18 | 5.7 | 212.2 | -- | -- |
| 11:25 | 5 | 30 | 400 | 0.00 | 3.70 | 10.55 | 0.383 | 29.13 | 9.94 | 5.8 | 214.5 | -- | -- |
| 11:30 | 5 | 35 | 400 | 0.00 | 4.23 | 10.23 | 0.351 | 26.61 | 9.7 | 5.9 | 216.9 | -- | -- |
| 11:35 | 5 | 40 | 400 | 0.00 | 4.76 | 10.18 | 0.347 | 25.52 | 9.68 | 6 | 217.2 | -- | -- |
| 11:40 | 5 | 45 | 400 | 0.00 | 5.28 | 10.6 | 0.44 | 25.51 | 9.81 | 5.9 | 213.5 | -- | -- |
| 11:45 | 5 | 50 | 400 | 0.00 | 5.81 | 10.12 | 0.36 | 21.59 | 9.63 | 5.9 | 215.9 | -- | -- |
| 11:50 | 5 | 55 | 400 | 0.00 | 6.34 | 10.06 | 0.355 | 20.42 | 9.58 | 6 | 218.2 | -- | -- |
| 11:55 | 5 | 60 | 400 | 0.00 | 6.87 | 10.06 | 0.351 | 19.79 | 9.55 | 5.9 | 213.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |
| Total Organic Carbon | 250mL HDPE Plastic | 1 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-R7 | | | **Date** | 04/19/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 30.2 degrees F and Cloudy. The wind is blowing N/NW at 11.4 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 12:20 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:00 | **Volumes Purged** | | **Sample ID** | VRTB-S-R7_04192022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:55 | **Gallons Purged** | 3.76 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:40 | 0 | 0 | 150 | 0.00 | 0.79 | 8.22 | 1.026 | 100.13 | 10.74 | 4.3 | 246.2 | -- | -- |
| 12:45 | 5 | 5 | 150 | 0.00 | 0.99 | 8.3 | 0.997 | 151.13 | 10.87 | 4.3 | 246.2 | -- | -- |
| 12:50 | 5 | 10 | 150 | 0.00 | 1.19 | 8.38 | 0.955 | 132.32 | 10.9 | 4.2 | 246.6 | -- | -- |
| 12:55 | 5 | 15 | 150 | 0.00 | 1.39 | 8.42 | 0.932 | 105.92 | 10.78 | 4.2 | 246.7 | -- | -- |
| 13:00 | 5 | 20 | 150 | 0.00 | 1.59 | 8.42 | 0.803 | 66.05 | 10.53 | 4.5 | 246.4 | -- | -- |
| 13:05 | 5 | 25 | 150 | 0.00 | 1.78 | 8.41 | 0.782 | 59.56 | 10.51 | 4.6 | 246.7 | -- | -- |
| 13:10 | 5 | 30 | 150 | 0.00 | 1.98 | 8.37 | 0.719 | 42.41 | 10.51 | 4.7 | 247.2 | -- | -- |
| 13:15 | 5 | 35 | 150 | 0.00 | 2.18 | 8.31 | 0.701 | 37.33 | 10.51 | 4.5 | 250.6 | -- | -- |
| 13:20 | 5 | 40 | 150 | 0.00 | 2.38 | 8.32 | 0.682 | 33.11 | 10.56 | 4.5 | 251.9 | -- | -- |
| 13:25 | 5 | 45 | 150 | 0.00 | 2.58 | 8.3 | 0.653 | 29.8 | 10.58 | 4.4 | 253.9 | -- | -- |
| 13:35 | 10 | 55 | 150 | 0.00 | 2.97 | 8.31 | 0.65 | 29.11 | 10.62 | 4.1 | 256.8 | -- | -- |
| 13:40 | 5 | 60 | 150 | 0.00 | 3.17 | 8.26 | 0.597 | 20.69 | 10.6 | 4.2 | 258.3 | -- | -- |
| 13:45 | 5 | 65 | 150 | 0.00 | 3.37 | 8.26 | 0.616 | 19.11 | 10.55 | 4.3 | 260 | -- | -- |
| 13:50 | 5 | 70 | 150 | 0.00 | 3.57 | 8.27 | 0.612 | 18.75 | 10.55 | 4.2 | 261.8 | -- | -- |
| 13:55 | 5 | 75 | 150 | 0.00 | 3.76 | 8.28 | 0.609 | 18.61 | 10.55 | 4.2 | 263.5 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS 537.1 mod | 250mL HDPE Plastic | 2 | None |
| Total Organic Carbon | 250mL HDPE Plastic | 1 | None |

**Comments:** This well would only produce approximately 200 ml/min while purging as fast as the peristaltic would allow.

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Well Locked at Arrival: no

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | |
|---|---|---|---|
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

**ARCADIS**

# Water Sampling Log

Project ESTCP GAAF | Project No. 30027244 | Page 1 of 3

Site Location Grayling MI | Date 4/13/2022

Site/Well No. VRTB-D-P8 | Replicate No. _____ | Code No. _____

Weather 50°F cloudy | Sampling Time: Begin 1346 End 1348

## Evacuation Data

Measuring Point _____

MP Elevation (ft) _____

Land Surface Elevation (ft) _____

Sounded Well Depth (ft bmp) _____

Depth to Water (ft bmp) _____

Water-Level Elevation (ft) _____

Water Column in Well (ft) _____

Casing Diameter/Type _____

Gallons in Well _____

Gallons Pumped/Bailed Prior to Sampling _____

Sample Pump Intake Setting (ft bmp) _____

Purge Time begin 1149 end 1346

Pumping Rate (ml/min) _____

Evacuation Method low flow

## Field Parameters

Temperature (°C) _____

SpC (mS/cm) _____

CND (mS/cm) _____

Dissolved Oxygen (%) _____

Dissolved Oxygen (mg/L) _____

pH (s.u.) _____

ORP (mV) _____

Turbidity (NTU) _____

Color _____

Odor _____

Appearance _____

Sampling Method low flow

Remarks Ventilation well

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | HDPE 250ml | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

Blue (3 min)

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : D-P6 PROJ #: 30027244.00003

DATE : 4/13/2022 LOC: ESTES GRAFF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1149 | pump on | | | | | | | 350 | | |
| 1203 | 11.2 | 2.680 | 1.961 | 78.6 | 8.54 | 11.90 | 63.7 | | 2600 | |
| 1206 | 11.2 | 2.321 | 1.700 | 78.0 | 8.50 | 11.88 | 59.3 | | 3900 | |
| 1209 | 11.1 | 2.172 | 2.168 | 84.0 | 9.20 | 11.97 | 59.1 | | 1210 | |
| 1212 | 11.1 | 1.945 | 1.428 | 87.5 | 9.57 | 11.93 | 58.7 | | 1865 | |
| 1215 | 11.2 | 1.798 | 1.321 | 91.7 | 10.02 | 11.89 | 59.0 | | 1090 | |
| 1218 | 11.1 | 1.666 | 1.223 | 92.9 | 10.16 | 11.86 | 59.1 | | 1650 | |
| 1221 | 11.1 | 1.542 | 1.131 | 93.6 | 10.25 | 11.83 | 59.2 | | 2150 | |
| 1224 | 11.2 | 1.452 | 1.067 | 95.2 | 10.42 | 11.80 | 59.5 | | 980 | |
| 1227 | 11.1 | 1.352 | 0.991 | 95.5 | 10.47 | 11.77 | 59.8 | | 1300 | |
| 1230 | 11.3 | 1.282 | 0.947 | 95.7 | 10.43 | 11.73 | 59.8 | | 1430 | |
| 1233 | 11.2 | 1.240 | 0.913 | 97.2 | 10.61 | 11.69 | 60.2 | | 210 | |
| 1236 | 11.4 | 1.177 | 0.870 | 97.5 | 10.61 | 11.66 | 60.6 | | 215 | |
| 1239 | 11.4 | 1.126 | 0.833 | 96.4 | 10.50 | 11.64 | 60.4 | | 38 | |
| 1242 | 11.4 | 1.087 | 0.804 | 96.1 | 10.48 | 11.61 | 60.6 | | 35 | |
| 45 | 11.4 | 1.046 | 0.774 | 95.4 | 10.38 | 11.58 | 61.0 | | 35 | |
| 48 | | silicone tubing broke / replacing / pump off | | | | | | | | |
| 51 | pump on | | | | | | | 450 | | |
| ~~5748~~ | 10.8 | 1.006 | 0.733 | 91.3 | 10.06 | 11.51 | 63.9 | | 30 | |
| ~~5748~~ | | | | | | | | | | |
| 1300 | 11.0 | 0.959 | 0.702 | 91.9 | 10.12 | 11.50 | | | 15 | |
| 03 | 11.0 | 0.925 | 0.678 | 91.6 | 10.06 | 11.45 | 54.6 | | 12 | |
| 06 | 11.0 | 0.898 | 0.644 | 91.4 | 10.04 | 11.41 | 57.2 | | 12.4 | |
| 09 | 11.0 | 0.845 | 0.618 | 91.0 | 10.01 | 11.37 | 58.7 | | 14.5 | |
| 12 | 11.0 | 0.819 | 0.600 | 90.8 | 9.98 | 11.34 | 59.9 | | 13. | |
| 15 | 11.0 | 0.797 | 0.584 | 90.9 | 9.99 | 11.31 | 61.3 | | 19 | |
| 18 | 11.0 | 0.766 | 0.560 | 91.0 | 9.90 | 11.27 | 62.7 | | 14.5 | |
| 21 | 11.1 | 0.748 | 0.549 | 90.5 | 9.95 | 11.23 | 63.9 | | 11.9 | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Blue

Blue

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : D-P8 PROJ #: 30027244.00003

DATE : 4/13/2022 LOC: ESTCP GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1324 | 11.1 | 0.737 | 0.541 | 90.1 | 9.90 | 11.21 | 64.4 | | 14 | |
| 27 | 11.0 | 0.723 | 0.530 | 90.0 | 9.89 | 11.18 | 65.0 | | | |
| 1330 | 11.0 | 0.700 | 0.513 | 89.4 | 9.84 | 11.13 | 65.7 | | 10.9 | |
| 33 | 11.2 | 0.690 | 0.506 | 89.3 | 9.78 | 11.10 | 66.6 | | 11.5 | |
| 36 | 11.1 | 0.678 | 0.497 | 88.9 | 9.77 | 11.07 | 67.9 | | 12.5 | |
| 39 | 11.0 | 0.668 | 0.490 | 88.1 | 9.69 | 11.04 | 69.5 | | 14.5 | |
| 42 | 11.1 | 0.660 | 0.484 | 87.7 | 9.64 | 11.01 | 70.8 | | 11.8 | |
| 1345 | Collect sample | | | VBTB-D-P8-04132022 | | | | @ 1346 | | |
| 48 | | | | | | | | | | |
| 51 | | | | | | | | | | |
| 54 | | | | | | | | | | |
| 57 | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Blue

Blue

**ARCADIS**

# Water Sampling Log

Project: ESTCP GSAAF | Project No.: 30027241 | Page: 1 of 3

Site Location: Grayling MI | Date: 4/13/2022

Site/Well No.: VRTB-D-01 | Replicate No.: | Code No.:

Weather: 49°F cloudy | Sampling Time: Begin 1345 End 1347

## Evacuation Data

Measuring Point:

MP Elevation (ft):

Land Surface Elevation (ft):

Sounded Well Depth (ft bmp):

Depth to Water (ft bmp):

Water-Level Elevation (ft):

Water Column in Well (ft):

Casing Diameter/Type:

Gallons in Well:

Gallons Pumped/Bailed Prior to Sampling:

Sample Pump Intake Setting (ft bmp):

Purge Time: begin 1151 end 1347

Pumping Rate (ml/min):

Evacuation Method: low flow

## Field Parameters

Temperature (°C):

SpC (mS/cm):

CND (mS/cm):

Dissolved Oxygen (%):

Dissolved Oxygen (mg/L):

pH (s.u.):

ORP (mV):

Turbidity (NTU):

Color:

Odor:

Appearance:

Sampling Method: low flow

Remarks: Vertical well

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250 ml HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

White (3 min)

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : D-CLL PROJ #: 30027244.00003

DATE : 4/13/2022 LOC: ESTCP GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1151 | purge on | | | | | | | 330 | | |
| 1203 | 10.2 | 1.987 | 1.370 | 11.6 | 1.32 | 6.63 | -85.4 | | 8.72 | |
| 1206 | 10.2 | 1.402 | 1.045 | 22.6 | 2.53 | 6.69 | -80.0 | | 100 | |
| 1209 | 10.2 | 1.270 | 0.908 | 29.0 | 3.26 | 6.71 | -73.7 | | 19.5 | |
| 1212 | 10.3 | 1.130 | 0.808 | 34.2 | 3.84 | 6.75 | -66.6 | | 40.0 | |
| 1215 | 10.3 | 1.047 | 0.752 | 38.3 | 4.28 | 6.77 | -61.3 | | 70.0 | |
| 1218 | 10.2 | 0.961 | 0.688 | 41.1 | 4.61 | 6.80 | -57.2 | | 16.5 | |
| 1221 | 10.4 | 0.901 | 0.647 | 43.3 | 4.85 | 6.83 | -54.1 | | 25.0 | |
| 1224 | 10.3 | 0.862 | 0.619 | 45.4 | 5.08 | 6.85 | -51.1 | | 3.22 | |
| 1227 | 10.2 | 0.824 | 0.590 | 46.1 | 5.18 | 6.87 | -48.0 | | 2.14 | |
| 1230 | 10.4 | 0.794 | 0.570 | 47.6 | 5.32 | 6.90 | -47.5 | | 9.75 | |
| 1233 | 10.3 | 0.765 | 0.550 | 48.3 | 5.40 | 6.91 | -45.4 | | 2.20 | |
| 36 | 10.4 | 0.735 | 0.530 | 49.2 | 5.48 | 6.93 | -43.4 | | 1.85 | |
| 39 | 10.3 | 0.712 | 0.513 | 50.2 | 5.60 | 6.94 | -42.8 | | 3.5 | |
| 42 | 10.3 | 0.693 | 0.499 | 50.9 | 5.69 | 6.96 | -41.5 | | 3.5 | |
| 45 | 10.4 | 0.672 | 0.485 | 51.8 | 5.77 | 6.97 | -39.7 | | 2.5 | |
| 48 | 10.5 | 0.653 | 0.471 | 52.1 | 5.81 | 6.99 | -39.0 | | 1.8 | |
| 51 | 10.5 | 0.636 | 0.460 | 53.2 | 5.92 | 6.99 | -38.0 | | 2.9 | |
| 54 | 10.3 | 0.620 | 0.446 | 53.9 | 6.04 | 7.02 | -36.9 | | 2.0 | |
| 57 | 10.4 | 0.609 | 0.438 | 53.5 | 5.97 | 7.02 | -36.4 | | 3.2 | |
| 1300 | 10.4 | 0.597 | 0.431 | 54.0 | 6.02 | 7.04 | -36.3 | | 2.5 | |
| 03 | 10.5 | 0.593 | 0.428 | 54.4 | 6.07 | 7.05 | -35.7 | | 5.5 | |
| 06 | 10.3 | 0.574 | 0.413 | 54.7 | 6.11 | 7.06 | -35.0 | | 2.8 | |
| 09 | 10.4 | 0.564 | 0.406 | 54.9 | 6.13 | 7.07 | -34.0 | | 4.0 | |
| 12 | 10.4 | 0.555 | 0.400 | 55.1 | 6.15 | 7.08 | -31.8 | | 2.6 | |
| 15 | 10.4 | 0.537 | 0.388 | 56.1 | 6.26 | 7.10 | -29.4 | | 3.8 | |
| 18 | 10.4 | 0.531 | 0.383 | 56.1 | 6.27 | 7.10 | -27.4 | | 2.0 | |
| 21 | 10.5 | 0.522 | 0.377 | 56.9 | 6.34 | 7.12 | -25.9 | | 1.9 | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

White

White

Bubbles

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : D-06 PROJ #: 30027244.0003

DATE : 4/13/2022 LOC: ESTCP GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1324 | 10.5 | 0.573 | 0.371 | 57.1 | 6.36 | 7.13 | -25.8 | | 2.7 | |
| 27 | 10.5 | 0.506 | 0.367 | 57.1 | 6.37 | 7.13 | -30.3 | | | |
| 1330 | 10.5 | 0.502 | 0.363 | 57.6 | 6.42 | 7.13 | -31.3 | | 12.8 | |
| 33 | 10.6 | 0.497 | 0.360 | 58.4 | 6.48 | 7.14 | -31.7 | | 3.5 | |
| 36 | 10.6 | 0.492 | 0.356 | 58.1 | 6.48 | 7.15 | -30.6 | | 2.2 | |
| 39 | 10.4 | 0.485 | 0.350 | 57.9 | 6.46 | 7.15 | -28.3 | | 4.5 | |
| 42 | 10.5 | 0.482 | 0.348 | 58.3 | 6.50 | 7.16 | -27.6 | | 2.6 | |
| 45 | Collect sample | | | VRTB-D-06-041322022 @ 1345 | | | | | | |
| 48 | | | | | | | | | | |
| 51 | | | | | | | | | | |
| 54 | | | | | | | | | | |
| 57 | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

White

White

**ARCADIS**

# Water Sampling Log

Project: ESTCP GAAF | Project No.: 30027244 | Page: 1 of 2

Site Location: Grayling MI | Date: 4/13/2022

Site/Well No.: VRTB-D-MW5 | Replicate No.: | Code No.:

Weather: 50°F cloudy | Sampling Time: Begin 1512 End 1515

## Evacuation Data

| | |
|---|---|
| Measuring Point | |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | |
| Purge Time | begin 1408 end 1515 |
| Pumping Rate (ml/min) | |
| Evacuation Method | low flow |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | low flow |
| Remarks | vertical well |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250ml HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Husbands

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : D-MS PROJ #: 30027244.00003

DATE : 4/13/2022 LOC: ESTCP GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1408 | purge on | | | | | | | 310 | | |
| 1415 | 10.3 | 1.600 | 1.149 | 2.7 | 0.29 | 7.60 | -124.8 | | 9.7 | |
| 18 | 10.4 | 1.344 | 0.966 | 0.7 | 0.07 | 7.55 | -132.0 | | | |
| 21 | 10.4 | 0.976 | 0.701 | 2.1 | 0.24 | 7.46 | -130.0 | | | |
| 24 | 10.5 | 0.754 | 0.544 | 7.1 | 0.79 | 7.47 | -126.2 | | | |
| 27 | 10.6 | 0.674 | 0.488 | 10.6 | 1.18 | 7.50 | -123.4 | | 7.5 | |
| 30 | 10.4 | 0.622 | 0.449 | 14.4 | 1.61 | 7.53 | -119.2 | | | |
| 33 | 10.6 | 0.587 | 0.426 | 18.7 | 2.08 | 7.55 | -113.9 | | | |
| 36 | 10.6 | 0.554 | 0.401 | 22.9 | 2.55 | 7.57 | -108.8 | | 6 | |
| 39 | 10.7 | 0.531 | 0.385 | 26.1 | 2.90 | 7.60 | -105.4 | | | |
| 42 | 10.5 | 0.507 | 0.367 | 29.4 | 3.27 | 7.62 | -100.1 | | | |
| 45 | 10.4 | 0.492 | 0.355 | 31.7 | 3.54 | 7.64 | -96.4 | | | |
| 48 | 10.7 | 0.478 | 0.347 | 33.9 | 3.77 | 7.66 | -93.3 | | | |
| 51 | 10.7 | 0.467 | 0.339 | 35.8 | 3.97 | 7.68 | -90.7 | | 6 | |
| 54 | 10.5 | 0.458 | 0.331 | 37.3 | 4.16 | 7.70 | -89.7 | | | |
| 57 | 10.6 | 0.448 | 0.324 | 38.6 | 4.30 | 7.71 | -86.8 | | 5.5 | |
| 1500 | 10.5 | 0.440 | 0.319 | 39.9 | 4.45 | 7.72 | -84.3 | | 5.8 | |
| 03 | 10.2 | 0.433 | 0.311 | 40.9 | 4.58 | 7.74 | -82.0 | | 4 | |
| 06 | 10.2 | 0.427 | 0.306 | 42.0 | 4.71 | 7.74 | -78.5 | | 3.7 | |
| 09 | 10.2 | 0.422 | 0.303 | 42.9 | 4.80 | 7.76 | -75.8 | | 3.5 | |
| 12 | Collect single | | | VRTB-DMS_ | | 041320 | 22@ | | 1512 | |
| 15 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

White

White

**ARCADIS**

# Water Sampling Log

Project: ESTCP GAAF | Project No.: 30027244 | Page: 1 of 3

Site Location: Grayling MI | Date: 4/13/2022

Site/Well No.: VRTB-D-R7 | Replicate No.: | Code No.:

Weather: 50°F cloudy | Sampling Time: Begin 1033 End 1035

| Evacuation Data | | Field Parameters | |
|---|---|---|---|
| Measuring Point | | Temperature (°C) | |
| MP Elevation (ft) | | SpC (mS/cm) | |
| Land Surface Elevation (ft) | | CND (mS/cm) | |
| Sounded Well Depth (ft bmp) | | Dissolved Oxygen (%) | |
| Depth to Water (ft bmp) | | Dissolved Oxygen (mg/L) | |
| Water-Level Elevation (ft) | | pH (s.u.) | |
| Water Column in Well (ft) | | ORP (mV) | |
| Casing Diameter/Type | | Turbidity (NTU) | |
| Gallons in Well | | Color | |
| Gallons Pumped/Bailed Prior to Sampling | | Odor | |
| | | Appearance | |
| Sample Pump Intake Setting (ft bmp) | | Sampling Method | low flow |
| Purge Time | begin 1406 end 1033 | Remarks | Vertebrae well |
| Pumping Rate (ml/min) | | | |
| Evacuation Method | low flow | | |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250 ml HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : D-R7 PROJ #: 30027244.00003

DATE : 4/13/2022 LOC: ESTCP GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1408 | purge | on | | | | | | 340 | | |
| 1415 | 10.3 | 3.276 | 2.350 | 1.4 | 0.15 | 6.71 | -97.8 | | 9.2 | |
| 18 | 10.3 | 2.844 | 2.040 | 1.9 | 0.21 | 6.6 | -102.3 | | | |
| 21 | 10.3 | 2.530 | 1.826 | 0.4 | 0.05 | 6.77 | -105.0 | | | |
| 24 | 10.6 | 2.280 | 1.649 | -0.3 | -0.03 | 6.80 | -107.0 | | | |
| 27 | 10.6 | 2.130 | 1.542 | -0.4 | -0.05 | 6.79 | -106.8 | | 7.0 | |
| 30 | 10.4 | 2.006 | 1.445 | -0.6 | -0.06 | 6.80 | -107.5 | | | |
| 33 | 10.7 | 1.883 | 1.366 | -0.8 | -0.08 | 6.81 | -108.4 | | | |
| 36 | 10.7 | 1.767 | 1.283 | -0.9 | -0.10 | 6.83 | -109.5 | | 7 | |
| 39 | 10.7 | 1.674 | 1.217 | -1.2 | -0.13 | 6.84 | -110.4 | | | |
| 42 | 10.6 | 1.584 | 1.146 | -1.3 | -0.14 | 6.86 | -111.1 | | | |
| 45 | 10.4 | 1.507 | 1.085 | -1.4 | -0.16 | 6.88 | -111.5 | | | |
| 48 | 10.6 | 1.444 | 1.045 | -1.5 | -0.16 | 6.89 | -112.1 | | | |
| 51 | 10.6 | 1.382 | 1.002 | -1.5 | -0.17 | 6.90 | -112.4 | | 4 | |
| 54 | 10.5 | 1.327 | 0.959 | -1.6 | -0.18 | 6.91 | -112.6 | | | |
| 57 | 10.5 | 1.268 | 0.917 | -1.6 | -0.18 | 6.92 | -113.0 | | 5.1 | |
| 1500 | 10.5 | 1.223 | 0.884 | -1.5 | -0.17 | 6.93 | -113.1 | | 8.28 | |
| 03 | 10.3 | 1.174 | 0.849 | -1.5 | -0.17 | 6.94 | -113.2 | | 4.75 | |
| 06 | 10.2 | 1.138 | 0.817 | -1.4 | -0.15 | 6.95 | -113.2 | | 3.25 | |
| 09 | 10.4 | 1.102 | 0.793 | -1.3 | -0.15 | 6.95 | -112.8 | | 3.6 | |
| 12 | 10.2 | 1.066 | 0.764 | -1.2 | -0.13 | 6.96 | -112.7 | | 3.5 | |
| 15 | 10.3 | 1.035 | 0.745 | -1.1 | -0.12 | 6.96 | -112.7 | | 3.5 | |
| 18 | 10.3 | 1.004 | 0.722 | -1.0 | -0.11 | 6.97 | -112.7 | | 4.1 | |
| 21 | 10.2 | 0.981 | 0.703 | -0.5 | -0.05 | 6.98 | -112.4 | | 4.3 | |
| 24 | 10.2 | 0.953 | 0.682 | -0.5 | -0.06 | 6.99 | -112.3 | | 3.4 | |
| 27 | 10.2 | 0.929 | 0.664 | -0.3 | -0.03 | 7.00 | -112.0 | | 3.4 | |
| 1530 | 10.3 | 0.905 | 0.650 | 0.0 | -0.00 | 7.00 | -111.6 | | 3.5 | |
| 1533 | 10.1 | 0.885 | 0.633 | 0.2 | 0.02 | 7.01 | -111.2 | | 3.9 | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Blue

Blue

1.252

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : D-R7 PROJ #: 30027244.00003

DATE : 4/13/2022 LOC: ESTCP GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1536 | | | | | | | | | | |
| 39 | 10.2 | 0.846 | 0.6666 | 0.9 | 0.10 | 7.02 | -109.8 | | 3.8 | |
| 42 | 10.2 | 0.833 | 0.597 | 1.2 | 0.14 | 7.03 | -109.3 | | 3.5 | |
| 45 | 10.2 | 0.815 | 0.584 | 1.5 | 0.16 | 7.04 | -108.6 | | | |
| 48 | 10.0 | 0.801 | 0.571 | 1.8 | 0.20 | 7.05 | -107.8 | | | |
| 51 | 10.0 | 0.777 | 0.555 | 2.4 | 0.27 | 7.05 | -106.7 | | 3.3 | |
| 54 | 9.9 | 0.764 | 0.543 | 2.7 | 0.30 | 7.05 | -105.3 | | | |
| 57 | 10.1 | 0.750 | 0.536 | 3.2 | 0.36 | 7.06 | -104.4 | | | |
| 1600 | 10.0 | 0.738 | 0.527 | 3.7 | 0.41 | 7.07 | -103.7 | | 3.5 | |
| 1603 | 10.0 | 0.726 | 0.518 | 4.2 | 0.47 | 7.08 | -102.5 | | | |
| 06 | 10.0 | 0.714 | 0.509 | 4.7 | 0.53 | 7.08 | -101.3 | | 3.1 | |
| 09 | 9.8 | 0.703 | 0.500 | 5.0 | 0.57 | 7.09 | -99.9 | | 3.0 | |
| 12 | 10.0 | 0.6996 | 0.497 | 5.3 | 0.60 | 7.09 | -99.0 | | 2.7 | |
| 15 | 10.1 | 0.685 | 0.491 | 6.0 | 0.67 | 7.10 | -97.6 | | 2.8 | |
| 18 | 9.9 | 0.674 | 0.479 | 6.5 | 0.73 | 7.11 | -96.3 | | 2.6 | |
| 21 | 9.9 | 0.6668 | 0.475 | 6.9 | 0.78 | 7.12 | -95.3 | | 2.8 | |
| 24 | 10.0 | 0.658 | 0.470 | 7.5 | 0.85 | 7.12 | -93.8 | | 2.7 | |
| 27 | 10.0 | 0.651 | 0.465 | 8.0 | 0.90 | 7.13 | -92.7 | | 2.5 | |
| 30 | 10.0 | 0.645 | 0.460 | 8.2 | 0.93 | 7.13 | -91.8 | | 2.8 | |
| 33 | Collected | single | VRTB-D-R7 | 04/13/2022 @ 1633 | | | | | | |
| 35 | pump off | | | | | | | | | |
| 39 | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

**ARCADIS**

# Water Sampling Log

Project: ESTCP GAAF | Project No.: 30027244 | Page: 1 of 2

Site Location: Grayling MI | Date: 4/14/2022

Site/Well No.: D-B1 | Replicate No.: | Code No.:

Weather: 35°F partly sunny | Sampling Time: Begin 1046 End 1051

## Evacuation Data

| | |
|---|---|
| Measuring Point | |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | |
| Purge Time | begin 1032 end 1051 |
| Pumping Rate (ml/min) | |
| Evacuation Method | low flow |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | low flow |
| Remarks | Westbrook well |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250ml HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : D-B1 PROJ #: 30027241.00003

DATE : 4/14/2022 LOC: ESTCP GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 932 | pump on | | | | | | | 400 | | |
| | | | | | | | | | | |
| 941 | | | | | | | | | | |
| 945 | 8.0 | 0.866 | 0.583 | 57.3 | 6.44 | 11.23 | -28.6 | | 23 | |
| 950 | 8.0 | 0.714 | 0.482 | 63.8 | 7.56 | 10.91 | -24.3 | | 23.5 | |
| 955 | 8.1 | 0.674 | 0.456 | 67.4 | 7.95 | 10.86 | -24.7 | | 26 | |
| 1000 | 8.1 | 0.663 | 0.448 | 68.0 | 8.03 | 10.95 | -25.9 | | 32 | |
| 1005 | 8.1 | 0.650 | 0.440 | 67.7 | 7.98 | 10.96 | -28.5 | | 19 | |
| 1010 | 8.1 | 0.632 | 0.428 | 68.2 | 8.03 | 10.81 | -27.8 | | 16 | |
| 1015 | 8.1 | 0.568 | 0.384 | 67.2 | 7.91 | 10.39 | -20.7 | | 18 | |
| 1020 | 8.2 | 0.542 | 0.371 | 66.2 | 7.81 | 10.30 | -17.9 | | 16 | |
| 1025 | 8.2 | 0.530 | 0.360 | 68.5 | 8.06 | 10.26 | -18.0 | | 17 | |
| 1030 | 8.2 | 0.521 | 0.353 | 68.2 | 8.04 | 10.21 | -17.6 | | 18 | |
| 1035 | 8.2 | 0.510 | 0.346 | 68.8 | 8.10 | 10.18 | -17.5 | | 14 | |
| 1040 | 8.1 | 0.504 | 0.341 | 68.9 | 8.12 | 10.17 | -17.9 | | 15 | |
| 1045 | 8.2 | 0.498 | 0.338 | 69.6 | 8.20 | 10.14 | -18.0 | | 14 | |
| 1048 | Collect sample | | | VOCs-D-B1-041420220 1048 | | | | | | |
| 1051 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

White

White

**ARCADIS**

# Water Sampling Log

Project: ESTCP GAAF | Project No.: 30027244 | Page: 1 of 3

Site Location: Grayling MI | Date: 11/14/20

Site/Well No.: WTB-D-52 | Replicate No.: | Code No.:

Weather: 35°F partly sunny | Sampling Time: Begin 1213 End 1216

## Evacuation Data

| | |
|---|---|
| Measuring Point | |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | |
| Purge Time | begin 922 end 1216 |
| Pumping Rate (ml/min) | |
| Evacuation Method | low flow |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | low flow |
| Remarks | neighbor well |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250 ml HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL: D-S2 PROJ #: 30027244.00003

DATE: 4/14/2022 LOC: ESTCP GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 922 | purging | | | | | | | 350 | | |
| | | | | | | | | | | |
| 940 | 7.9 | 3.439 | 2.310 | -1.5 | -0.17 | 6.51 | -43.6 | | 60 | |
| 945 | 7.9 | 3.359 | 2.241 | -1.7 | -1.20 | 6.54 | -46.9 | | 12.3 | |
| 950 | 7.9 | 3.251 | 2.190 | -1.9 | -0.22 | 6.56 | -50.3 | | 8.6 | |
| 955 | 8.0 | 3.114 | 2.102 | -2.1 | -0.25 | 6.59 | -54.1 | | 7.8 | |
| 1000 | 8.0 | 2.983 | 2.012 | -2.2 | -0.26 | 6.61 | -56.8 | | 10 | |
| 1005 | 8.1 | 2.830 | 1.915 | -2.3 | -0.27 | 6.63 | -59.3 | | 5.3 | |
| 1010 | 8.1 | 2.702 | 1.830 | -2.4 | -0.28 | 6.65 | -61.2 | | 4.8 | |
| 1015 | 8.1 | 2.586 | 1.738 | -2.4 | -0.28 | 6.66 | -62.8 | | 5.2 | |
| 1020 | 8.2 | 2.451 | 1.663 | -2.5 | -0.29 | 6.68 | -64.2 | | 4.5 | |
| 1025 | 8.1 | 2.343 | 1.587 | -2.5 | -0.29 | 6.69 | -65.4 | | 4.2 | |
| 1030 | 8.2 | 2.217 | 1.503 | -2.4 | -0.29 | 6.71 | -66.7 | | 4.6 | |
| 1035 | 8.1 | 2.149 | 1.456 | -2.4 | -0.28 | 6.72 | -67.3 | | 6.1 | |
| 1040 | 8.1 | 2.075 | 1.404 | -2.3 | -0.27 | 6.72 | -67.8 | | 3.3 | |
| 1045 | 8.2 | 1.998 | 1.359 | -2.1 | -0.25 | 6.73 | -68.5 | | 4.5 | |
| 1050 | 8.3 | 1.915 | 1.302 | -1.9 | -023 | 6.75 | -69.5 | | 3.2 | |
| 1055 | 8.2 | 1.869 | 1.267 | -1.8 | -0.21 | 6.76 | -70.0 | | 4.7 | |
| 1100 | 8.3 | 1.809 | 1.229 | -1.6 | -0.19 | 6.77 | -70.6 | | 4.1 | |
| 1105 | 8.4 | 1.751 | 1.194 | -1.4 | -0.16 | 6.78 | -71.4 | | 4.7 | |
| 1110 | 8.3 | 1.710 | 1.166 | -1.2 | -0.14 | 6.78 | -71.7 | | 3.2 | |
| 1115 | 8.4 | 1.670 | 1.140 | -0.9 | -0.10 | 6.79 | -71.9 | | 3.8 | |
| 1120 | 8.4 | 1.624 | 1.108 | -0.6 | -0.07 | 6.80 | -72.2 | | 4.0 | |
| 1125 | 8.4 | 1.592 | 1.088 | -0.3 | -0.04 | 6.80 | -72.2 | | 3.1 | |
| 1130 | 8.3 | 1.552 | 1.058 | 0.0 | 0.00 | 6.83 | -72.3 | | 3.7 | |
| 1135 | 8.2 | 1.523 | 1.034 | 0.3 | 0.03 | 6.82 | -72.2 | | 4.3 | |
| 1140 | 8.4 | 1.495 | 1.020 | 0.6 | 0.08 | 6.82 | -72.3 | | 3.7 | |
| 1145 | 8.5 | 1.471 | 1.009 | 1.0 | 0.12 | 6.82 | -72.5 | | 3.2 | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Blue

Blue

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : D-S2 PROJ #: 30027244.00003

DATE : 4/14/2022 LOC: ESTCP GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1150 | 8.4 | 1.447 | 0.988 | 1.3 | 0.16 | 6.83 | -72.1 | | 3.4 | |
| 1155 | 8.4 | 1.419 | 0.970 | 1.7 | 0.20 | 6.84 | -72.1 | | 3.5 | |
| 1200 | 8.4 | 1.401 | 0.956 | 2.1 | 0.24 | 6.84 | -71.1 | | 4.1 | |
| 1205 | 8.5 | 1.377 | 0.943 | 2.5 | 0.29 | 6.84 | -71.6 | | 3.7 | |
| 1210 | 8.6 | 1.360 | 0.933 | 2.8 | 0.33 | 6.84 | -71.3 | | 3.3 | |
| 1213 | Collect single VBTS-D-S2-0414-2022 | | | | | | | | | |
| 1216 | pmp off | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Blue

**ARCADIS**

# Water Sampling Log

Project: ESTCP GAAF | Project No.: 30027244 | Page: 1 of 2

Site Location: Grayling MI | Date: 4/14/22

Site/Well No.: VRTB-D-64 | Replicate No.: | Code No.:

Weather: 35°F partly sunny | Sampling Time: Begin 1220 End 1224

| Evacuation Data | | Field Parameters | |
|---|---|---|---|
| Measuring Point | | Temperature (°C) | |
| MP Elevation (ft) | | SpC (mS/cm) | |
| Land Surface Elevation (ft) | | CND (mS/cm) | |
| Sounded Well Depth (ft bmp) | | Dissolved Oxygen (%) | |
| Depth to Water (ft bmp) | | Dissolved Oxygen (mg/L) | |
| Water-Level Elevation (ft) | | pH (s.u.) | |
| Water Column in Well (ft) | | ORP (mV) | |
| Casing Diameter/Type | | Turbidity (NTU) | |
| Gallons in Well | | Color | |
| Gallons Pumped/Bailed Prior to Sampling | | Odor | |
| | | Appearance | |
| Sample Pump Intake Setting (ft bmp) | | Sampling Method | Low flow |
| Purge Time | begin 1102 end 1224 | Remarks | vertical well |
| Pumping Rate (ml/min) | | | |
| Evacuation Method | low flow | | |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250ml HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hawbrack

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : D-64 PROJ #: 30022244.00003

DATE : 4/14/2022 LOC: ESTCP GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1102 | pump on | | | | | | | 300 | Bubbles | |
| | | | | | | | | | | |
| 1110 | 8.2 | 1.063 | 0.714 | 1.8 | 0.21 | 7.06 | -98.2 | | 2.8 | |
| 1115 | 8.1 | 0.774 | 0.525 | 1.6 | 0.19 | 7.13 | -109.0 | | 2.4 | |
| 1120 | 8.1 | 0.594 | 0.401 | 11.0 | 1.31 | 7.19 | -108.1 | | 2.1 | |
| 1125 | 8.3 | 0.513 | 0.349 | 18.9 | 2.23 | 7.24 | -103.4 | | 1.8 | |
| 1130 | 8.1 | 0.463 | 0.313 | 25.2 | 2.98 | 7.29 | -97.8 | | 1.6 | |
| 1135 | 8.0 | 0.426 | 0.288 | 31.4 | 3.72 | 7.31 | -89.8 | | 1.6 | |
| 1140 | 8.2 | 0.412 | 0.279 | 35.4 | 4.18 | 7.34 | -85.0 | | 2.4 | |
| 1145 | 8.4 | 0.400 | 0.273 | 38.0 | 4.45 | 7.39 | -83.4 | | 1.57 | |
| 1150 | 8.2 | 0.391 | 0.265 | 40.5 | 4.77 | 7.40 | -79.0 | | 1.56 | |
| 1155 | 8.3 | 0.383 | 0.261 | 42.7 | 5.02 | 7.42 | -76.0 | | 1.32 | |
| 1200 | 8.1 | 0.376 | 0.255 | 44.3 | 5.24 | 7.42 | -72.5 | | 1.47 | |
| 1205 | 8.4 | 0.369 | 0.252 | 46.9 | 5.49 | 7.43 | -70.0 | | 2.60 | |
| 1210 | 8.4 | 0.367 | 0.251 | 46.8 | 5.49 | 7.46 | -69.6 | | 1.74 | |
| 1215 | 8.3 | 0.362 | 0.247 | 48.5 | 5.69 | 7.45 | -66.4 | | 1.56 | |
| 1220 | Collect sample VRTB-D-64-04142022 | | | | | | | | | |
| 1225 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

white

white

**ARCADIS**

# Water Sampling Log

Project: ESTCP GIAAF | Project No.: 30027244 | Page: 1 of 2

Site Location: Grayling MI | Date: 4/14/22

Site/Well No.: VRTB-D-Y3 | Replicate No.: | Code No.:

Weather: 35°F partly sunny | Sampling Time: Begin 1353 End 1410

| Evacuation Data | | Field Parameters | |
|---|---|---|---|
| Measuring Point | | Temperature (°C) | |
| MP Elevation (ft) | | SpC (mS/cm) | |
| Land Surface Elevation (ft) | | CND (mS/cm) | |
| Sounded Well Depth (ft bmp) | | Dissolved Oxygen (%) | |
| Depth to Water (ft bmp) | | Dissolved Oxygen (mg/L) | |
| Water-Level Elevation (ft) | | pH (s.u.) | |
| Water Column in Well (ft) | | ORP (mV) | |
| Casing Diameter/Type | | Turbidity (NTU) | |
| Gallons in Well | | Color | |
| Gallons Pumped/Bailed Prior to Sampling | | Odor | |
| | | Appearance | |
| Sample Pump Intake Setting (ft bmp) | | Sampling Method | Low flow |
| Purge Time | begin 1231 end 1400 | Remarks | VERTICAL well |
| Pumping Rate (ml/min) | | | |
| Evacuation Method | Low flow | | |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250 ml HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hardwick

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : D-Y3 PROJ #: 30702724.4.00003

DATE : 4/14/2022 LOC: GAAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1231 | pump on | | | | | | | 300 | | |
| | | | | | | | | | | |
| 1250 | 8.6 | 1.136 | 0.776 | 39.2 | 4.58 | 7.15 | -103.0 | | 2.8 | |
| 1255 | 8.6 | 1.057 | 0.724 | 41.8 | 4.87 | 7.15 | -96.7 | | 2.9 | |
| 1300 | 8.4 | 0.985 | 0.671 | 43.9 | 5.14 | 7.18 | -89.8 | | 2.6 | |
| 1305 | 8.5 | 0.929 | 0.635 | 45.7 | 5.33 | 7.17 | -84.6 | | 2.6 | |
| 1310 | 8.3 | 0.886 | 0.603 | 46.5 | 5.46 | 7.18 | -79.8 | | 2.4 | |
| 1315 | 8.2 | 0.853 | 0.580 | 47.2 | 5.55 | 7.19 | -76.6 | | 2.3 | |
| 1320 | 8.4 | 0.828 | 0.566 | 47.6 | 5.57 | 7.23 | -75.6 | | 2.3 | |
| 1325 | 8.7 | 0.801 | 0.552 | 48.8 | 5.67 | 7.22 | -73.6 | | 2.6 | |
| 1330 | 8.6 | 0.778 | 0.534 | 49.5 | 5.78 | 7.22 | -70.0 | | 2.7 | |
| 1335 | 8.5 | 0.758 | 0.520 | 49.7 | 5.80 | 7.23 | -69.6 | | 3.0 | |
| 1340 | 8.7 | 0.737 | 0.507 | 50.9 | 5.91 | 7.27 | -69.3 | | 2.5 | |
| 1345 | 8.6 | 0.728 | 0.500 | 50.6 | 5.89 | 7.24 | -66.6 | | 3.0 | |
| 1350 | 8.7 | 0.718 | 0.495 | 50.8 | 5.90 | 7.26 | -67.2 | | 3.3 | |
| ~~1353~~ | 1353 | Collect | sample | | MW3-D-Y3-04142022 @ 1353 | | | | | |
| 1400 | 1355 | pump off | | | | | | | | |
| 1405 | | | | | | | | | | |
| 1410 | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

0.058
0.857

**ARCADIS**

# Water Sampling Log

Project: ESTCP GAAF | Project No.: 30027244 | Page: 1 of 2

Site Location: Grayling MI | Date: 4/14/22

Site/Well No.: VCTB-S-G24 | Replicate No.: | Code No.:

Weather: 35°F partly cloudy | Sampling Time: Begin 1530 End 1532

| Evacuation Data | | Field Parameters | |
|---|---|---|---|
| Measuring Point | | Temperature (°C) | |
| MP Elevation (ft) | | SpC (mS/cm) | |
| Land Surface Elevation (ft) | | CND (mS/cm) | |
| Sounded Well Depth (ft bmp) | | Dissolved Oxygen (%) | |
| Depth to Water (ft bmp) | | Dissolved Oxygen (mg/L) | |
| Water-Level Elevation (ft) | | pH (s.u.) | |
| Water Column in Well (ft) | | ORP (mV) | |
| Casing Diameter/Type | | Turbidity (NTU) | |
| Gallons in Well | | Color | |
| Gallons Pumped/Bailed Prior to Sampling | | Odor | |
| | | Appearance | |
| Sample Pump Intake Setting (ft bmp) | | Sampling Method | low flow |
| Purge Time | begin 1434 end 1532 | Remarks | vertebrae well |
| Pumping Rate (ml/min) | | | |
| Evacuation Method | low flow | | |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250ml HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : S-[redacted]G4 PROJ #: 30027244

DATE : 4/14/2022 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1434 | pump on | | | | | | | 410 | | |
| | | | | | | | | | | |
| 1450 | 7.5 | 0.603 | 0.402 | 36.0 | 4.31 | 7.99 | -55.6 | | 4.1 | |
| 1455 | 7.4 | 0.612 | 0.407 | 44.2 | 5.30 | 7.99 | -49.6 | | | |
| 1500 | 7.4 | 0.608 | 0.403 | 48.2 | 5.81 | 7.98 | -45.4 | | | |
| 1505 | 7.4 | 0.608 | 0.404 | 49.0 | 5.89 | 7.97 | -39.6 | | 3 | |
| 1570 | 7.4 | 0.566 | 0.376 | 54.6 | 6.57 | 7.96 | -35.2 | | 3.4 | |
| 1515 | 7.5 ✓ | 0.593 | 0.395 | 54.9 ✓ | 6.57 | 7.97 ✓ | -~~69~~ -31.4 | | 3.5 | |
| 1520 | 7.5 | 0.602 | 0.401 | 52.5 | 6.32 | 7.98 | -30.6 | | 3 | |
| 1525 | 7.3 | 0.594 | 0.394 | 50.8 | 6.82 | 7.99 | -28.1 | | 2.3 | |
| 1530 | Collect Sample VRTB-S-G4-04142022 @ 1530 | | | | | | | | | |
| 1532 | pump off | | | | | | | | | |

| | |
|---|---|
| Total Depth of Well: | |
| Depth To Water Before Purging: | |
| Depth To Water After Purging: | |

white

white

**ARCADIS**

# Water Sampling Log

Project: ESTCP GSAAF | Project No.: 30027244 | Page: 1 of 2

Site Location: Grayling MI | Date: 4/14/22

Site/Well No.: VRTB-S-S2 | Replicate No.: | Code No.:

Weather: 35°F gently sunny | Sampling Time: Begin 1553 End 1555

| Evacuation Data | | Field Parameters | |
|---|---|---|---|
| Measuring Point | | Temperature (°C) | |
| MP Elevation (ft) | | SpC (mS/cm) | |
| Land Surface Elevation (ft) | | CND (mS/cm) | |
| Sounded Well Depth (ft bmp) | | Dissolved Oxygen (%) | |
| Depth to Water (ft bmp) | | Dissolved Oxygen (mg/L) | |
| Water-Level Elevation (ft) | | pH (s.u.) | |
| Water Column in Well (ft) | | ORP (mV) | |
| Casing Diameter/Type | | Turbidity (NTU) | |
| Gallons in Well | | Color | |
| Gallons Pumped/Bailed Prior to Sampling | | Odor | |
| | | Appearance | |
| Sample Pump Intake Setting (ft bmp) | | Sampling Method | low flow |
| Purge Time | begin 1436 end 1555 | Remarks | vertical well |
| Pumping Rate (ml/min) | | | |
| Evacuation Method | low flow | | |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250ml HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : S-[illegible] 52 PROJ #: 30027244

DATE : 4/14/2022 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1436 | pump on | | | | | | | 500 | | |
| | | | | | | | | | | |
| 1450 | 7.6 | 0.632 | 0.422 | 27.7 | 3.31 | 750 | 7.3 | | 72 | |
| 1455 | 7.5 | 0.604 | 0.403 | 36.5 | 4.37 | 7.52 | 13.7 | | | |
| 1500 | 7.4 | 0.574 | 0.382 | 40.9 | 4.91 | 7.55 | 18.6 | | | |
| 1505 | 7.6 | 0.534 | 0.357 | 47.3 | 5.65 | 7.57 | 27.2 | | 42 | |
| 1570 | 7.3 | 0.516 | 0.342 | 51.1 | 6.15 | 7.58 | 33.0 | | | |
| 1515 | 7.3 | 0.501 | 0.332 | 56.1 | 6.75 | 7.58 | 41.6 | | 28 | |
| 1520 | 7.5 | 0.495 | 0.330 | 55.8 | 6.70 | 7.60 | 47.1 | | | |
| 1525 | 7.4 | 0.485 | 0.323 | 60.0 | 7.19 | 7.60 | 53.1 | | | |
| 1530 | 7.3 | 0.479 | 0.317 | 61.2 | 7.36 | 7.61 | 58.6 | | 21 | |
| 1535 | 7.5 | 0.476 | 0.317 | 60.5 | 7.26 | 7.62 | 65.0 | | 22 | |
| 1540 | ~~Collect sample~~ | | | | | | | | 195 | |
| 1540 | 7.3 | 0.469 | 0.310 | 63.5 | 7.64 | 7.63 | 69.2 | | 19 | |
| 1545 | 7.4 | 0.465 | 0.309 | 64.3 | 7.73 | 7.63 | 73.5 | | 18 | |
| 1550 | 7.3 | 0.461 | 0.305 | 63.6 | 7.65 | 7.64 | 78.5 | | 18.5 | |
| 1553 | Collect sample | | | VRTB-S-52-041422022 @ | | | | 1553 | | |
| 1555 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Blue

Blue

**ARCADIS**

# Water Sampling Log

Project: ESTCP GAAF | Project No.: 30027244 | Page: 1 of 2

Site Location: Grayling MI | Date: 4/14/22

Site/Well No.: VBTB-S-B1 | Replicate No.: | Code No.:

Weather: 35°F partly sunny | Sampling Time: Begin 1747 End ~~1800~~ 1750

| Evacuation Data | | Field Parameters | |
|---|---|---|---|
| Measuring Point | | Temperature (°C) | |
| MP Elevation (ft) | | SpC (mS/cm) | |
| Land Surface Elevation (ft) | | CND (mS/cm) | |
| Sounded Well Depth (ft bmp) | | Dissolved Oxygen (%) | |
| Depth to Water (ft bmp) | | Dissolved Oxygen (mg/L) | |
| Water-Level Elevation (ft) | | pH (s.u.) | |
| Water Column in Well (ft) | | ORP (mV) | |
| Casing Diameter/Type | | Turbidity (NTU) | |
| Gallons in Well | | Color | |
| Gallons Pumped/Bailed Prior to Sampling | | Odor | |
| | | Appearance | |
| Sample Pump Intake Setting (ft bmp) | | Sampling Method | low flow |
| Purge Time | begin 1544 end ~~1800~~ 1750 | Remarks | VBTB-S well |
| Pumping Rate (ml/min) | | | |
| Evacuation Method | low flow | | |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

AFB3 Vapor Columbus Lake

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : S-B1 PROJ #: 30027244. 0000 3

DATE : 4/14/2022 LOC: ESTCP GAAFB

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1544 | pump on | | | | | | | 500 | | |
| | | | | | | | | | | |
| 1555 | 7.2 | 2.451 | 1.613 | -0.2 | -0.02 | 6.83 | -18.3 | | 20 | |
| 1600 | 7.2 | 1.897 | 1.248 | 1.0 | 0.12 | 6.93 | -23.0 | | | |
| 1605 | 7.2 | 1.736 | 1.144 | 3.4 | 0.42 | 7.04 | -29.9 | | 2.0 | |
| 1610 | 7.2 | 1.548 | 1.017 | 9.2 | 1.10 | 7.11 | -31.1 | | | |
| 1615 | 7.2 | 1.305 | 0.860 | 15.9 | 1.91 | 7.17 | -30.9 | | | |
| 1620 | 7.2 | 1.224 | 0.806 | 19.4 | 2.35 | 7.19 | -29.9 | | | |
| 1625 | 7.2 | 1.126 | 0.743 | 21.8 | 2.62 | 7.21 | -27.3 | | | |
| 1630 | 7.2 | 1.034 | 0.681 | 30.1 | 3.64 | 7.24 | -25.3 | | 3.5 | |
| 1635 | 7.2 | 0.974 | 0.641 | 41.1 | 4.96 | 7.26 | -20.9 | | | |
| 1640 | 7.1 | 0.920 | 0.606 | 44.2 | 5.33 | 7.28 | -18.6 | | | |
| 1645 | 7.1 | 0.863 | 0.568 | 48.1 | 5.80 | 7.30 | -14.7 | | 5.0 | |
| 1650 | ~~7~~ | | | | | | | | | |
| 1655 | 7.1 | 0.838 | 0.551 | 53.0 | 6.41 | 7.32 | -11.6 | | | |
| 1700 | | | | | | | | | | |
| 1705 | 7.1 | 0.783 | 0.515 | 57.8 | 6.97 | 7.34 | -7.1 | | | |
| 1710 | 7.1 | 0.759 | 0.500 | 58.1 | 7.02 | 7.35 | -5.7 | | | |
| 1715 | | | | | | | | | | |
| 1720 | 7.1 | 0.735 | 0.484 | 61.7 | 7.45 | 7.36 | -3.8 | | 4.0 | |
| 1725 | 7.1 | ✓0.719 | 0.473 | 63.0 | ✓7.62 | 7.37 ✗ | -0.9 | | 5.0 | |
| 1730 | 7.1 | ✓0.702 | 0.462 | 64.9 | ✓7.83 | 7.38 ✗ | 1.3 | | 5.5 | |
| 1735 | 7.1 | 0.709 | 0.466 | 67.2 | 8.12 | 7.38 | 2.2 | | 3.5 | |
| 1740 | 7.1 | 0.689 | 0.452 | 70.4 | 8.52 | 7.39 | 3.2 | | 2.0 | |
| 1745 | 7.1 | 0.677 | 0.445 | 70.1 | 8.48 | 7.39 | 4.2 | | 2.5 | |
| ~~1750~~ | 1747 | Collect Sample | | | | VETB-S-B1-04142022 @ | | | 1745 | |
| 1800 | 1750 | pump off | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

initial

white

**ARCADIS**

# Water Sampling Log

Project: ESTCP GAAF | Project No.: 30027244 | Page: 1 of 2

Site Location: Grayling MI | Date: 4/4/22

Site/Well No.: VPTB-S-Y3 | Replicate No.: | Code No.:

Weather: | Sampling Time: Begin 1755 End 1758

| Evacuation Data | | Field Parameters | |
|---|---|---|---|
| Measuring Point | | Temperature (°C) | |
| MP Elevation (ft) | | SpC (mS/cm) | |
| Land Surface Elevation (ft) | | CND (mS/cm) | |
| Sounded Well Depth (ft bmp) | | Dissolved Oxygen (%) | |
| Depth to Water (ft bmp) | | Dissolved Oxygen (mg/L) | |
| Water-Level Elevation (ft) | | pH (s.u.) | |
| Water Column in Well (ft) | | ORP (mV) | |
| Casing Diameter/Type | | Turbidity (NTU) | |
| Gallons in Well | | Color | |
| Gallons Pumped/Bailed Prior to Sampling | | Odor | |
| | | Appearance | |
| Sample Pump Intake Setting (ft bmp) | | Sampling Method | low flow |
| Purge Time | begin 1558 end 1758 | Remarks | vertical well |
| Pumping Rate (ml/min) | | | |
| Evacuation Method | low flow | | |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250ml HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Harbrecht

**Well Casing Volumes**

| Gal./Ft. | | | | | |
|---|---|---|---|---|---|
| | 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| | 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : S-Y3 PROJ #: 30027244.00003

DATE : 4/14/2022 LOC: ESTCP GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1558 | pump on | | | | | | | | | |
| | | | | | | | | | | |
| 1620 | 7.2 | 1.433 | 0.938 | 15.8 | 1.90 | 7.29 | -50.3 | | | |
| 1625 | 7.2 | 1.322 | 0.872 | 22.9 | 2.77 | 7.25 | -45.9 | | | |
| 1630 | 7.2 | 1.235 | 0.808 | 26.3 | 3.17 | 7.29 | -46.4 | | 18 | |
| 1635 | 7.2 | 1.073 | 0.707 | 30.2 | 3.64 | 7.33 | -46.4 | | | |
| 1640 | 7.2 | 1.048 | 0.691 | 31.3 | 3.78 | 7.32 | -44.6 | | | |
| 1645 | — | — | mixed | blew | over | equipment | | | | |
| 1650 | 7.1 | 0.974 | 0.641 | 35.5 | 4.29 | 7.34 | -41.1 | | 9.5 | |
| 1655 | 7.1 | 0.957 | 0.630 | 36.6 | 4.42 | 7.34 | -40.5 | | | |
| 1700 | — | — | mixed | blew | over | equipment | | | | |
| 1705 | 7.1 | 0.914 | 0.602 | 40.3 | 4.86 | 7.36 | -38.8 | | | |
| 1710 | 7.2 | 0.887 | 0.585 | 42.4 | 5.10 | 7.36 | -37.4 | | 19 | |
| 1715 | — | — | mixed | blew | over | equipment | | | | |
| 1720 | 7.1 | 0.868 | 0.569 | 42.5 | 5.13 | 7.39 | -37.2 | | 18 | |
| 1725 | 7.1 | 0.809 | 0.533 | 45.3 | 5.47 | 7.40 | -35.5 | | | |
| 1730 | 7.1 | 0.813 | 0.536 | 46.2 | 5.57 | 7.39 | -33.2 | | 8.3 | |
| 1735 | 7.1 | 0.844 | 0.555 | 44.7 | 5.39 | 7.35 | -31.1 | | 8.2 | |
| 1740 | 7.1 | 0.789 | 0.520 | 46.5 | 5.62 | 7.41 | -32.7 | | 8.3 | |
| 1745 | 7.0 | 0.781 | 0.513 | 46.8 | 5.66 | 7.41 | -31.3 | | 8.4 | |
| 1750 | 7.0 | 0.775 | 0.509 | 46.7 | 5.66 | 7.41 | -30.7 | | 9.3 | |
| 1755 | Collect Sample | | | VRTB-S-Y3-041422022 @ 1755 | | | | | | |
| ~~1800~~ 1758 | pump off | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

Blue

Blue

**ARCADIS**

# Water Sampling Log

Project: ESTCP GAAF | Project No.: 30027244 | Page: 1 of 2

Site Location: Grayling MI | Date: 4/15/22

Site/Well No.: VRTB-S-OC6 | Replicate No.: | Code No.:

Weather: 45°F cloudy | Sampling Time: Begin 1142 End 1145

## Evacuation Data

| | |
|---|---|
| Measuring Point | |
| MP Elevation (ft) | |
| Land Surface Elevation (ft) | |
| Sounded Well Depth (ft bmp) | |
| Depth to Water (ft bmp) | |
| Water-Level Elevation (ft) | |
| Water Column in Well (ft) | |
| Casing Diameter/Type | |
| Gallons in Well | |
| Gallons Pumped/Bailed Prior to Sampling | |
| Sample Pump Intake Setting (ft bmp) | |
| Purge Time | begin 1002 end 1145 |
| Pumping Rate (ml/min) | |
| Evacuation Method | low flow |

## Field Parameters

| | |
|---|---|
| Temperature (°C) | |
| SpC (mS/cm) | |
| CND (mS/cm) | |
| Dissolved Oxygen (%) | |
| Dissolved Oxygen (mg/L) | |
| pH (s.u.) | |
| ORP (mV) | |
| Turbidity (NTU) | |
| Color | |
| Odor | |
| Appearance | |
| Sampling Method | low flow |
| Remarks | verkiborne well |

| Constituents Sampled | Container Description | Number | Preservative |
|---|---|---|---|
| PFAS | 250ml HDPE | 2 | none |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sampling Personnel: K. Hasbrouck

**Well Casing Volumes**

| Gal./Ft. | | | | |
|---|---|---|---|---|
| 0.5" = 0.01 | 1-¼" = 0.06 | 2" = 0.16 | 3" = 0.37 | 4" = 0.65 |
| 1" = 0.04 | 1-½" = 0.09 | 2-½" = 0.26 | 3-½" = 0.50 | 6" = 1.47 |

| | | | | | |
|---|---|---|---|---|---|
| bmp | Below measuring point | mL | Milliliter | NTU | Nephelometric turbidity units |
| °C | Degrees Celsius | mS/cm | Millisiemens per centimeter | PVC | Polyvinyl chloride |
| ft | Feet | msl | Mean sea level | s.u. | Standard units |
| gpm | Gallons per minute | N/A | Not applicable | umhos/cm | Micromhos per centimeter |
| mg/L | Milligrams per liter | NR | Not recorded | VOC | Volatile organic compounds |

**ARCADIS**

## YSI/LOW FLOW SAMPLING LOG



WELL : S-06 PROJ #: 30027244

DATE : 4/15/2022 LOC: GAAF

| Time | Temp Degree C | SpC mS/cm | CND mS/cm | DO% | DO mg/L | pH | ORP mV | Flow Rate mL/min | Turbidity NTU | DTW |
|---|---|---|---|---|---|---|---|---|---|---|
| 1002 | pmp | on | | | | | | 550 | | |
| | | | | | | | | | | |
| 1025 | 7.4 | 1.156 | 0.766 | 34.6 | 4.16 | 7.35 | 67.4 | 450 | | |
| 1030 | 7.4 | 1.029 | 0.681 | 40.6 | 4.87 | 7.38 | 56.8 | | | |
| 1035 | 7.3 | 0.967 | 0.640 | 43.1 | 5.17 | 7.40 | 50.9 | | | |
| 1040 | 7.4 | 0.916 | 0.607 | 44.8 | 5.39 | 7.42 | 45.5 | | | |
| 1045 | 7.5 | 0.848 | 0.563 | 52.3 | 6.26 | 7.44 | 39.4 | | | |
| 1050 | 7.4 | 0.791 | 0.525 | 54.8 | 6.56 | 7.46 | 35.7 | | | |
| 1055 | ~~7.4~~ | ~~0.755~~ | | | | | | | | |
| 1100 | 7.4 | 0.755 | 0.501 | 56.0 | 6.72 | 7.48 | 34.1 | | 5 | |
| 1105 | 7.5 | 0.745 | 0.497 | 59.9 | 7.17 | 7.48 | 32.7 | | 3 | |
| 1110 | 7.4 | 0.725 | 0.481 | 62.1 | 7.45 | 7.50 | 31.9 | | 2.5 | |
| 1115 | 7.3 | 0.706 | 0.468 | 62.7 | 7.52 | 7.51 | 31.4 | | | |
| 1120 | 7.3 | 0.681 | 0.451 | 63.7 | 7.65 | 7.52 | 32.3 | | 2.3 | |
| 1125 | 7.4 | 0.666 | 0.441 | 63.4 | 7.62 | 7.52 | 32.5 | | 2.0 | |
| 1130 | 7.5 | 0.653 | 0.434 | 63.8 | 7.64 | 7.53 | 27.6 | | 2.1 | |
| 1135 | 7.6 | 0.640 | 0.427 | 63.8 | 7.62 | 7.53 | 23.0 | | 2.3 | |
| 1140 | 7.6 | 0.637 | 0.425 | 63.8 | 7.63 | 7.53 | 20.3 | | 2.0 | |
| ~~1145~~ | 1142 | Collect | Sample | | VETB-S-06-0415 | | 2022 | | 1142 | |
| | 1145 | pmp off | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Total Depth of Well: | | | | | | | | | | |
| Depth To Water Before Purging: | | | | | | | | | | |
| Depth To Water After Purging: | | | | | | | | | | |

white

white

# Groundwater Sampling Logs

# Performance Monitoring Event #3

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_1 | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 85 °F, Overcast, winds at mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 14.50 | **Total Depth (ft-bmp)** | 15 | **Water Column (ft)** | 0.5 | **Gallons in Well** | |
| **Purge Start** | 15:05 | **Pump Intake (ft-bmp)** | 15 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:30 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_1_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:25 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:10 | 0 | 0 | 200 | | 0.26 | 7.59 | 0.202 | 1.83 | 9.64 | 12.2 | 46.8 | -- | -- |
| 15:15 | 5 | 5 | 200 | | 0.53 | 7.57 | 0.2 | 1.41 | 9.54 | 12.2 | 46 | -- | -- |
| 15:20 | 5 | 10 | 200 | | 0.79 | 7.66 | 0.197 | 1.22 | 9.34 | 11.9 | 41.3 | -- | -- |
| 15:25 | 5 | 15 | 200 | | 1.06 | 7.67 | 0.195 | 1.09 | 9.26 | 11.9 | 42.1 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_2 | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 85 °F, Overcast, winds at mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 14.50 | **Total Depth (ft-bmp)** | 17 | **Water Column (ft)** | 2.5 | **Gallons in Well** | |
| **Purge Start** | 15:40 | **Pump Intake (ft-bmp)** | 17 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:15 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_2_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:10 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:45 | 0 | 0 | 200 | | 0.26 | 7.36 | 0.267 | 2.11 | 0.18 | 11.7 | 57.2 | -- | -- |
| 15:50 | 5 | 5 | 200 | | 0.53 | 7.35 | 0.265 | 1.73 | 0.21 | 11.6 | 55 | -- | -- |
| 15:55 | 5 | 10 | 200 | | 0.79 | 7.36 | 0.267 | 1.6 | 0.37 | 11.8 | 53.5 | -- | -- |
| 16:00 | 5 | 15 | 200 | | 1.06 | 7.4 | 0.266 | 1.4 | 0.18 | 11.6 | 49.8 | -- | -- |
| 16:05 | 5 | 20 | 200 | | 1.32 | 7.4 | 0.265 | 1.25 | 0.18 | 11.8 | 48.9 | -- | -- |
| 16:10 | 5 | 25 | 200 | | 1.59 | 7.4 | 0.265 | 1.25 | 0.18 | 11.8 | 48.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_3 | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 85 °F, Overcast, winds at mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 16.39 | **Total Depth (ft-bmp)** | 19.5 | **Water Column (ft)** | 3.11 | **Gallons in Well** | |
| **Purge Start** | 16:25 | **Pump Intake (ft-bmp)** | 19.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:55 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_3_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:50 | **Gallons Purged** | 1.59 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:30 | 0 | 0 | 200 | | 0.26 | 7.62 | 0.272 | 3.11 | 8.36 | 12.1 | 55.6 | -- | -- |
| 16:35 | 5 | 5 | 200 | | 0.53 | 7.55 | 0.271 | 2.61 | 8.5 | 12.1 | 60.5 | -- | -- |
| 16:40 | 5 | 10 | 200 | | 0.79 | 7.57 | 0.27 | 1.89 | 8.13 | 12.3 | 61.1 | -- | -- |
| 16:45 | 5 | 15 | 200 | | 1.06 | 7.56 | 0.271 | 1.66 | 8.12 | 12.3 | 61.3 | -- | -- |
| 16:50 | 5 | 20 | 200 | | 1.32 | 7.59 | 0.271 | 1.53 | 8.33 | 12.1 | 59.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_4 | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 85 °F, Overcast, winds at mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 16.39 | **Total Depth (ft-bmp)** | 23 | **Water Column (ft)** | 6.61 | **Gallons in Well** | |
| **Purge Start** | 17:05 | **Pump Intake (ft-bmp)** | 23 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:30 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_4_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:25 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:10 | 0 | 0 | 200 | | 0.26 | 7.73 | 0.223 | 1.61 | 8.47 | 11.9 | 52.2 | -- | -- |
| 17:15 | 5 | 5 | 200 | | 0.53 | 7.61 | 0.223 | 1.54 | 8.52 | 11.8 | 55.9 | -- | -- |
| 17:20 | 5 | 10 | 200 | | 0.79 | 7.6 | 0.224 | 1.41 | 8.5 | 11.9 | 54.6 | -- | -- |
| 17:25 | 5 | 15 | 200 | | 1.06 | 7.6 | 0.224 | 1.2 | 8.34 | 12 | 53.3 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_5 | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 85 °F, Overcast, winds at mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 16.39 | **Total Depth (ft-bmp)** | 26.5 | **Water Column (ft)** | 10.11 | **Gallons in Well** | |
| **Purge Start** | 17:40 | **Pump Intake (ft-bmp)** | 26.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:15 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_5_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:10 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:45 | 0 | 0 | 200 | 16.39 | 0.26 | 7.78 | 0.229 | 1.33 | 8.51 | 12.2 | 49 | -- | -- |
| 17:50 | 5 | 5 | 200 | 16.39 | 0.53 | 7.78 | 0.23 | 1.25 | 8.52 | 12.6 | 57.7 | -- | -- |
| 17:55 | 5 | 10 | 200 | 16.39 | 0.79 | 7.67 | 0.23 | 1.21 | 8.15 | 12.7 | 57.1 | -- | -- |
| 18:00 | 5 | 15 | 200 | 16.39 | 1.06 | 7.67 | 0.229 | 1.01 | 8.35 | 12.3 | 57.9 | -- | -- |
| 18:05 | 5 | 20 | 200 | 16.39 | 1.32 | 7.64 | 0.226 | 0.91 | 8.3 | 12.3 | 60.9 | -- | -- |
| 18:10 | 5 | 25 | 200 | 16.39 | 1.59 | 7.64 | 0.227 | 0.86 | 8.22 | 12.2 | 61.3 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_6 | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 85 °F, Overcast, winds at mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 16.39 | **Total Depth (ft-bmp)** | 30.5 | **Water Column (ft)** | 14.11 | **Gallons in Well** | |
| **Purge Start** | 18:25 | **Pump Intake (ft-bmp)** | 30.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:50 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_6_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:45 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:30 | 0 | 0 | 200 | 16.39 | 0.26 | 7.89 | 0.177 | 2.12 | 9.12 | 12.7 | 54.9 | -- | -- |
| 18:35 | 5 | 5 | 200 | 16.39 | 0.53 | 7.85 | 0.176 | 1.45 | 8.92 | 12.7 | 58.6 | -- | -- |
| 18:40 | 5 | 10 | 200 | 16.39 | 0.79 | 7.83 | 0.176 | 1.29 | 8.85 | 12.6 | 61.3 | -- | -- |
| 18:45 | 5 | 15 | 200 | 16.39 | 1.06 | 7.81 | 0.176 | 1.2 | 8.83 | 12.5 | 62 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_7 | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 85 °F, Overcast, winds at mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 16.39 | **Total Depth (ft-bmp)** | 36.5 | **Water Column (ft)** | 20.11 | **Gallons in Well** | |
| **Purge Start** | 18:50 | **Pump Intake (ft-bmp)** | 36.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 19:15 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_7_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 19:10 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:55 | 0 | 0 | 200 | 16.39 | 0.26 | 7.87 | 0.122 | 1.38 | 8.1 | 12.4 | 44.1 | -- | -- |
| 19:00 | 5 | 5 | 200 | 16.39 | 0.53 | 7.86 | 0.122 | 1.29 | 8.17 | 12.3 | 45.5 | -- | -- |
| 19:05 | 5 | 10 | 200 | 16.39 | 0.79 | 7.88 | 0.122 | 1.11 | 8.27 | 12.2 | 45.1 | -- | -- |
| 19:10 | 5 | 15 | 200 | 16.39 | 1.06 | 7.88 | 0.121 | 1.02 | 8.32 | 12.2 | 45.5 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-1D | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 85 °F, Overcast, winds at mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 13.68 | **Total Depth (ft-bmp)** | 30.28 | **Water Column (ft)** | 16.6 | **Gallons in Well** | 2.7 |
| **Purge Start** | 13:25 | **Pump Intake (ft-bmp)** | 27.78 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:55 | **Volumes Purged** | 0.59 | **Sample ID** | MW-VRTB-1D_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:50 | **Gallons Purged** | 1.59 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:30 | 0 | 0 | 200 | 13.68 | 0.26 | 7.83 | 0.2 | 1.89 | 8.67 | 12.4 | -43.7 | -- | -- |
| 13:35 | 5 | 5 | 200 | 13.68 | 0.53 | 7.67 | 0.197 | 1.55 | 8.63 | 12.7 | -20.2 | -- | -- |
| 13:40 | 5 | 10 | 200 | 13.68 | 0.79 | 7.7 | 0.197 | 1.51 | 8.86 | 12.6 | -8.5 | -- | -- |
| 13:45 | 5 | 15 | 200 | 13.68 | 1.06 | 7.72 | 0.199 | 1.45 | 8.91 | 12.6 | -3.5 | -- | -- |
| 13:50 | 5 | 20 | 200 | 13.68 | 1.32 | 7.75 | 0.199 | 1.22 | 8.92 | 12.8 | -1.1 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-1S | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 85 °F, Overcast, winds at mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 13.21 | **Total Depth (ft-bmp)** | 19.47 | **Water Column (ft)** | 6.26 | **Gallons in Well** | 1.02 |
| **Purge Start** | 14:00 | **Pump Intake (ft-bmp)** | 16.97 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:30 | **Volumes Purged** | 1.55 | **Sample ID** | MW-VRTB-1S_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:25 | **Gallons Purged** | 1.59 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:05 | 0 | 0 | 200 | 13.21 | 0.26 | 7.52 | 0.264 | 1.6 | 6.14 | 13.4 | 31.9 | -- | -- |
| 14:10 | 5 | 5 | 200 | 13.21 | 0.53 | 7.4 | 0.262 | 1.51 | 5.6 | 13.1 | 39.2 | -- | -- |
| 14:15 | 5 | 10 | 200 | 13.21 | 0.79 | 7.38 | 0.261 | 1.38 | 5.42 | 13.2 | 41.1 | -- | -- |
| 14:20 | 5 | 15 | 200 | 13.21 | 1.06 | 7.37 | 0.261 | 1.32 | 5.33 | 13.2 | 42.1 | -- | -- |
| 14:25 | 5 | 20 | 200 | 13.21 | 1.32 | 7.39 | 0.262 | 1.12 | 5.31 | 13.3 | 41.6 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-2D | | | **Date** | 06/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 82.4 degrees F and Cloudy. The wind is blowing S/SE at 10.3 mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 13.63 | **Total Depth (ft-bmp)** | 30.42 | **Water Column (ft)** | 16.79 | **Gallons in Well** | 2.73 |
| **Purge Start** | 17:05 | **Pump Intake (ft-bmp)** | 27.92 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:45 | **Volumes Purged** | 0.77 | **Sample ID** | MW-VRTB-2D_06142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:40 | **Gallons Purged** | 2.11 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:10 | 0 | 0 | 200 | 13.63 | 0.26 | 7.51 | 0.221 | 2.09 | 7.6 | 12.9 | 27.3 | -- | -- |
| 17:15 | 5 | 5 | 200 | 13.63 | 0.53 | 7.55 | 0.221 | 1.7 | 8.31 | 12.5 | 27.3 | -- | -- |
| 17:20 | 5 | 10 | 200 | 13.63 | 0.79 | 7.58 | 0.222 | 1.38 | 7.81 | 12.5 | 26.5 | -- | -- |
| 17:25 | 5 | 15 | 200 | 13.63 | 1.06 | 7.59 | 0.222 | 1.31 | 8.71 | 12.4 | 26.5 | -- | -- |
| 17:30 | 5 | 20 | 200 | 13.63 | 1.32 | 7.63 | 0.221 | 1.25 | 7.85 | 12.5 | 26.2 | -- | -- |
| 17:35 | 5 | 25 | 200 | 13.63 | 1.59 | 7.65 | 0.222 | 1.2 | 7.8 | 12.5 | 25.9 | -- | -- |
| 17:40 | 5 | 30 | 200 | 13.63 | 1.85 | 7.66 | 0.221 | 1.02 | 7.82 | 12.3 | 26.3 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-2S | | | **Date** | 06/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 80.6 degrees F and Cloudy. The wind is blowing S at 15.0 mph. | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 13.68 | **Total Depth (ft-bmp)** | 20.49 | **Water Column (ft)** | 6.81 | **Gallons in Well** | 1.11 |
| **Purge Start** | 17:55 | **Pump Intake (ft-bmp)** | 17.99 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:20 | **Volumes Purged** | 1.19 | **Sample ID** | MW-VRTB-2S_06142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:15 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | MS/MSD | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:00 | 0 | 0 | 200 | 13.68 | 0.26 | 7.58 | 0.246 | 1.71 | 4.16 | 11.6 | 18.8 | -- | -- |
| 18:05 | 5 | 5 | 200 | 13.68 | 0.53 | 7.43 | 0.243 | 1.56 | 4.65 | 11.7 | 29.9 | -- | -- |
| 18:10 | 5 | 10 | 200 | 13.68 | 0.79 | 7.47 | 0.239 | 1.46 | 4.77 | 11.5 | 30.4 | -- | -- |
| 18:15 | 5 | 15 | 200 | 13.68 | 1.06 | 7.48 | 0.238 | 1.31 | 4.73 | 11.6 | 29.5 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 6 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-3 | | | **Date** | 06/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 82 °F, Overcast, winds at mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 13.42 | **Total Depth (ft-bmp)** | 19.54 | **Water Column (ft)** | 6.12 | **Gallons in Well** | 0.99 |
| **Purge Start** | 18:50 | **Pump Intake (ft-bmp)** | 17.04 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 19:15 | **Volumes Purged** | 1.33 | **Sample ID** | MW-VRTB-3_06142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 19:10 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:55 | 0 | 0 | 200 | 13.42 | 0.26 | 7.69 | 0.295 | 2.08 | 8.79 | 10.8 | 53.5 | -- | -- |
| 19:00 | 5 | 5 | 200 | 13.42 | 0.53 | 7.65 | 0.292 | 1.94 | 8.91 | 10.6 | 54.1 | -- | -- |
| 19:05 | 5 | 10 | 200 | 13.42 | 0.79 | 7.64 | 0.292 | 1.63 | 9.25 | 10.6 | 53.2 | -- | -- |
| 19:10 | 5 | 15 | 200 | 13.42 | 1.06 | 7.67 | 0.289 | 1.41 | 9.26 | 10.6 | 52.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-B1 | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 76 °F, Overcast, winds at mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 09:20 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:30 | **Volumes Purged** | | **Sample ID** | VRTB-D-B1_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:25 | **Gallons Purged** | 3.43 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:30 | 0 | 0 | 200 | 0.00 | 0.53 | 11.65 | 1.49 | 3.76 | 2.01 | 14 | 134.4 | -- | -- |
| 09:35 | 5 | 5 | 200 | 0.00 | 0.79 | 11.45 | 1.13 | 2.61 | 3.1 | 13.7 | 126.8 | -- | -- |
| 09:40 | 5 | 10 | 200 | 0.00 | 1.06 | 11.33 | 0.96 | 2.1 | 3.48 | 13.7 | 124.2 | -- | -- |
| 09:45 | 5 | 15 | 200 | 0.00 | 1.32 | 11.19 | 0.81 | 1.96 | 3.89 | 13.8 | 121.2 | -- | -- |
| 09:50 | 5 | 20 | 200 | 0.00 | 1.59 | 11.12 | 0.75 | 1.84 | 4.22 | 13.3 | 120 | -- | -- |
| 09:55 | 5 | 25 | 200 | 0.00 | 1.85 | 10.85 | 0.56 | 1.76 | 4.52 | 14 | 114.1 | -- | -- |
| 10:00 | 5 | 30 | 200 | 0.00 | 2.11 | 10.81 | 0.55 | 1.7 | 4.7 | 14.1 | 112.1 | -- | -- |
| 10:05 | 5 | 35 | 200 | 0.00 | 2.38 | 10.8 | 0.53 | 1.61 | 4.78 | 13.9 | 111.3 | -- | -- |
| 10:10 | 5 | 40 | 200 | 0.00 | 2.64 | 10.72 | 0.5 | 1.46 | 4.85 | 13.9 | 110.5 | -- | -- |
| 10:15 | 5 | 45 | 200 | 0.00 | 2.64 | 10.63 | 0.479 | 1.33 | 4.89 | 13.9 | 108.5 | -- | -- |
| 10:20 | 5 | 50 | 200 | 0.00 | 3.17 | 10.61 | 0.47 | 1.21 | 4.93 | 13.9 | 110.5 | -- | -- |
| 10:25 | 5 | 55 | 200 | 0.00 | 3.43 | 10.58 | 0.465 | 1.09 | 4.99 | 14 | 108.5 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-G4 | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 76 °F, Overcast, winds at mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 12:00 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:10 | **Volumes Purged** | | **Sample ID** | VRTB-D-G4_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:05 | **Gallons Purged** | 3.70 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:40 | 0 | 0 | 200 | 0.00 | 2.11 | 7.13 | 0.365 | 1.77 | 1.69 | 15.1 | -53.9 | -- | -- |
| 12:45 | 5 | 5 | 200 | 0.00 | 2.38 | 7.28 | 0.355 | 1.62 | 1.8 | 15.5 | -60.4 | -- | -- |
| 12:50 | 5 | 10 | 200 | 0.00 | 2.64 | 7.24 | 0.348 | 1.6 | 2 | 15.3 | -54.6 | -- | -- |
| 12:55 | 5 | 15 | 200 | 0.00 | 2.91 | 7.24 | 0.334 | 1.34 | 2.12 | 15.2 | -48.7 | -- | -- |
| 13:00 | 5 | 20 | 200 | 0.00 | 3.17 | 7.23 | 0.334 | 1.21 | 2.15 | 15.3 | -46.6 | -- | -- |
| 13:05 | 5 | 25 | 200 | 0.00 | 3.43 | 7.29 | 0.327 | 1.26 | 2.19 | 15.2 | -46.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-M5 | | | **Date** | 06/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 64.4 degrees F and Cloudy. The wind is blowing SW at 9.2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 11:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:45 | **Volumes Purged** | | **Sample ID** | VRTB-D-M5_06132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:40 | **Gallons Purged** | 3.43 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:45 | 0 | 0 | 200 | 0.00 | 0.26 | 7.26 | 0.73 | 14.2 | 1.79 | 12.5 | 51.7 | -- | -- |
| 11:50 | 5 | 5 | 200 | 0.00 | 0.53 | 7.45 | 0.71 | 11.2 | 0.62 | 12.4 | 12.1 | -- | -- |
| 11:55 | 5 | 10 | 200 | 0.00 | 0.79 | 7.49 | 0.83 | 6.67 | 0.83 | 12.4 | -7.7 | -- | -- |
| 12:00 | 5 | 15 | 200 | 0.00 | 1.06 | 7.51 | 0.55 | 3.81 | 0.94 | 12.3 | -23.2 | -- | -- |
| 12:05 | 5 | 20 | 200 | 0.00 | 1.32 | 7.56 | 0.51 | 2.24 | 1.11 | 12.3 | -32.1 | -- | -- |
| 12:10 | 5 | 25 | 200 | 0.00 | 1.59 | 7.61 | 0.481 | 2.1 | 1.26 | 12.2 | -38.3 | -- | -- |
| 12:15 | 5 | 30 | 200 | 0.00 | 1.85 | 7.63 | 0.446 | 1.94 | 1.48 | 12.3 | -42.9 | -- | -- |
| 12:20 | 5 | 35 | 200 | 0.00 | 2.11 | 7.66 | 0.414 | 1.68 | 1.77 | 12.3 | -44.5 | -- | -- |
| 12:25 | 5 | 40 | 200 | 0.00 | 2.38 | 7.64 | 0.38 | 1.6 | 1.99 | 12.3 | -43.8 | -- | -- |
| 12:30 | 5 | 45 | 200 | 0.00 | 2.64 | 7.7 | 0.364 | 1.91 | 2.12 | 12.3 | -46.9 | -- | -- |
| 12:35 | 5 | 50 | 200 | 0.00 | 2.91 | 7.71 | 0.361 | 1.83 | 2.16 | 12.4 | -47.3 | -- | -- |
| 12:40 | 5 | 55 | 200 | 0.00 | 3.17 | 7.74 | 0.357 | 1.55 | 2.26 | 12.4 | -48.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-O6 | | | **Date** | 06/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 64.4 degrees F and Cloudy. The wind is blowing SW at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 12:50 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:55 | **Volumes Purged** | | **Sample ID** | VRTB-D-O6_06132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:50 | **Gallons Purged** | 2.11 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:20 | 0 | 0 | 200 | 0.00 | 1.59 | 6.84 | 0.79 | 5.44 | 2.14 | 12.7 | -36.9 | -- | -- |
| 13:25 | 5 | 5 | 200 | 0.00 | 1.85 | 6.86 | 0.75 | 4.11 | 2.07 | 12.8 | -37.5 | -- | -- |
| 13:30 | 5 | 10 | 200 | 0.00 | 2.11 | 6.88 | 0.7 | 3.54 | 2.09 | 12.7 | -38.3 | -- | -- |
| 13:35 | 5 | 15 | 200 | 0.00 | 2.38 | 6.9 | 0.63 | 3.02 | 2.07 | 12.7 | -37.9 | -- | -- |
| 13:40 | 5 | 20 | 200 | 0.00 | 2.64 | 6.92 | 0.61 | 1.84 | 2.11 | 12.7 | -37.2 | -- | -- |
| 13:45 | 5 | 25 | 200 | 0.00 | 2.91 | 6.96 | 0.6 | 2.34 | 2.12 | 12.6 | -37.4 | -- | -- |
| 13:50 | 5 | 30 | 200 | 0.00 | 3.17 | 6.96 | 0.6 | 2.19 | 2.13 | 12.6 | -37.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-P8 | | | **Date** | 06/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 64.4 degrees F and Cloudy. The wind is blowing SW at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 15:20 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:20 | **Volumes Purged** | | **Sample ID** | VRTB-D-P8_06132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:15 | **Gallons Purged** | 3.17 | **Replicate/ Code No.** | Dup-01_06132022 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:25 | 0 | 0 | 200 | 0.00 | 0.26 | 11.93 | 1.74 | 3.15 | 6.15 | 12.4 | -52.2 | -- | -- |
| 15:30 | 5 | 5 | 200 | 0.00 | 0.53 | 11.82 | 1.49 | 2.44 | 5.46 | 12.3 | -62.2 | -- | -- |
| 15:35 | 5 | 10 | 200 | 0.00 | 0.79 | 11.46 | 0.76 | 1.81 | 6.93 | 12.4 | -65.7 | -- | -- |
| 15:40 | 5 | 15 | 200 | 0.00 | 1.06 | 11.22 | 0.53 | 1.64 | 7.63 | 12.3 | -63.1 | -- | -- |
| 15:45 | 5 | 20 | 200 | 0.00 | 1.32 | 11.15 | 0.481 | 1.35 | 7.71 | 12.1 | -61.7 | -- | -- |
| 15:50 | 5 | 25 | 200 | 0.00 | 1.59 | 11.01 | 0.396 | 1.12 | 7.72 | 12.1 | -58.2 | -- | -- |
| 15:55 | 5 | 30 | 200 | 0.00 | 1.85 | 11.01 | 0.349 | 0.95 | 7.7 | 12.2 | -54.8 | -- | -- |
| 16:00 | 5 | 35 | 200 | 0.00 | 2.11 | 10.81 | 0.333 | 1.27 | 7.72 | 12 | -53.9 | -- | -- |
| 16:05 | 5 | 40 | 200 | 0.00 | 2.38 | 10.65 | 0.308 | 1.2 | 7.7 | 12.2 | -50.7 | -- | -- |
| 16:10 | 5 | 45 | 200 | 0.00 | 2.64 | 10.62 | 0.304 | 1.01 | 7.74 | 12.2 | -50.3 | -- | -- |
| 16:15 | 5 | 50 | 200 | 0.00 | 2.91 | 10.6 | 0.3 | 0.91 | 7.72 | 12.1 | -49.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 4 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-R7 | | | **Date** | 06/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 64.4 degrees F and Cloudy. The wind is blowing SW at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 14:05 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:15 | **Volumes Purged** | | **Sample ID** | VRTB-D-R7_06132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:10 | **Gallons Purged** | 3.70 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:10 | 0 | 0 | 200 | 0.00 | 0.26 | 6.85 | 0.97 | 13.9 | 0.49 | 12.5 | -21.4 | -- | -- |
| 14:15 | 5 | 5 | 200 | 0.00 | 0.53 | 6.71 | 1.1 | 7.55 | 0.41 | 12.4 | -18 | -- | -- |
| 14:20 | 5 | 10 | 200 | 0.00 | 0.79 | 6.72 | 1.07 | 3.08 | 0.3 | 12.7 | -22.5 | -- | -- |
| 14:25 | 5 | 15 | 200 | 0.00 | 1.06 | 6.77 | 0.93 | 2.47 | 0.33 | 12.5 | -30.9 | -- | -- |
| 14:30 | 5 | 20 | 200 | 0.00 | 1.32 | 6.79 | 0.89 | 2.21 | 0.37 | 12.3 | -34.7 | -- | -- |
| 14:35 | 5 | 25 | 200 | 0.00 | 1.59 | 6.81 | 0.83 | 1.55 | 0.45 | 12 | -37.2 | -- | -- |
| 14:40 | 5 | 30 | 200 | 0.00 | 1.85 | 6.82 | 0.8 | 1.39 | 0.44 | 11.8 | -38.4 | -- | -- |
| 14:45 | 5 | 35 | 200 | 0.00 | 2.11 | 6.84 | 0.74 | 1.18 | 0.48 | 11.9 | -41.1 | -- | -- |
| 14:50 | 5 | 40 | 200 | 0.00 | 2.38 | 6.85 | 0.74 | 1.29 | 0.46 | 11.7 | -41.5 | -- | -- |
| 14:55 | 5 | 45 | 200 | 0.00 | 2.64 | 6.87 | 0.72 | 1.45 | 0.49 | 11.8 | -42.5 | -- | -- |
| 15:00 | 5 | 50 | 200 | 0.00 | 2.91 | 6.9 | 0.68 | 1.9 | 0.49 | 11.5 | -44 | -- | -- |
| 15:05 | 5 | 55 | 200 | 0.00 | 3.17 | 6.9 | 0.67 | 1.72 | 0.49 | 11.6 | -43.8 | -- | -- |
| 15:10 | 5 | 60 | 200 | 0.00 | 3.43 | 6.9 | 0.66 | 1.5 | 0.48 | 11.5 | -43.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-S2 | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 76 °F, Overcast, winds at mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 10:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:10 | **Volumes Purged** | | **Sample ID** | VRTB-D-S2_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:05 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:40 | 0 | 0 | 200 | 0.00 | 0.26 | 6.7 | 1.79 | 2.24 | 0.48 | 14.9 | 77.1 | -- | -- |
| 10:45 | 5 | 5 | 200 | 0.00 | 0.53 | 6.63 | 1.58 | 2.02 | 0.41 | 14.8 | 47.3 | -- | -- |
| 10:50 | 5 | 10 | 200 | 0.00 | 0.79 | 6.67 | 1.49 | 1.66 | 0.5 | 14.8 | 32 | -- | -- |
| 10:55 | 5 | 15 | 200 | 0.00 | 1.06 | 6.7 | 1.45 | 1.63 | 0.52 | 14.6 | 25 | -- | -- |
| 11:00 | 5 | 20 | 200 | 0.00 | 1.32 | 6.72 | 1.41 | 1.44 | 0.55 | 14.5 | 18.2 | -- | -- |
| 11:05 | 5 | 25 | 200 | 0.00 | 1.59 | 6.73 | 1.41 | 1.34 | 0.52 | 14.5 | 15.3 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-Y3 | | | **Date** | 06/15/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 76 °F, Overcast, winds at mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 11:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:55 | **Volumes Purged** | | **Sample ID** | VRTB-D-Y3_06152022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:50 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:25 | 0 | 0 | 200 | 0.00 | 0.53 | 7.04 | 1.32 | 1.68 | 0.73 | 15.5 | -13.9 | -- | -- |
| 11:30 | 5 | 5 | 200 | 0.00 | 0.79 | 7.06 | 1.22 | 1.6 | 0.79 | 15.3 | -21.3 | -- | -- |
| 11:35 | 5 | 10 | 200 | 0.00 | 1.06 | 7.06 | 1.02 | 1.51 | 0.88 | 15.1 | -29 | -- | -- |
| 11:40 | 5 | 15 | 200 | 0.00 | 1.32 | 7.07 | 0.93 | 1.23 | 0.88 | 15.2 | -32.5 | -- | -- |
| 11:45 | 5 | 20 | 200 | 0.00 | 1.59 | 7.08 | 0.93 | 1.2 | 0.92 | 14.9 | -35.7 | -- | -- |
| 11:50 | 5 | 25 | 200 | 0.00 | 1.85 | 7.11 | 0.91 | 1.02 | 0.94 | 14.9 | -38.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-B1 | | | **Date** | 06/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 71.6 degrees F and Mostly Cloudy. The wind is blowing S/SE at 6.9 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 08:10 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:15 | **Volumes Purged** | | **Sample ID** | VRTB-L-B1_06142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:10 | **Gallons Purged** | 3.43 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:15 | 0 | 0 | 200 | 0.00 | 0.26 | 7.67 | 1.07 | 3.81 | 0.31 | 10.3 | 3.5 | -- | -- |
| 08:20 | 5 | 5 | 200 | 0.00 | 0.53 | 8.28 | 1.03 | 2.69 | 0.25 | 10.3 | -50.5 | -- | -- |
| 08:25 | 5 | 10 | 200 | 0.00 | 0.79 | 8.44 | 1 | 2.34 | 0.2 | 10.3 | -75.2 | -- | -- |
| 08:30 | 5 | 15 | 200 | 0.00 | 1.06 | 8.6 | 0.97 | 2.01 | 0.2 | 10.3 | -98.2 | -- | -- |
| 08:35 | 5 | 20 | 200 | 0.00 | 1.32 | 8.71 | 0.93 | 1.71 | 0.21 | 10.4 | -122.7 | -- | -- |
| 08:40 | 5 | 25 | 200 | 0.00 | 1.59 | 8.76 | 0.88 | 1.54 | 0.12 | 10.5 | -150.5 | -- | -- |
| 08:45 | 5 | 30 | 200 | 0.00 | 1.85 | 8.81 | 0.84 | 1.29 | 0.13 | 10.6 | -181.9 | -- | -- |
| 08:50 | 5 | 35 | 200 | 0.00 | 2.11 | 8.85 | 0.82 | 1.2 | 0.13 | 10.5 | -215.9 | -- | -- |
| 08:55 | 5 | 40 | 200 | 0.00 | 2.38 | 8.83 | 0.81 | 1.09 | 0.13 | 10.6 | -244.4 | -- | -- |
| 09:00 | 5 | 45 | 200 | 0.00 | 2.64 | 8.82 | 0.8 | 0.91 | 0.13 | 10.7 | -255.3 | -- | -- |
| 09:05 | 5 | 50 | 200 | 0.00 | 2.91 | 8.85 | 0.79 | 1.02 | 0.13 | 10.7 | -261.2 | -- | -- |
| 09:10 | 5 | 55 | 200 | 0.00 | 3.17 | 8.87 | 0.79 | 1.06 | 0.13 | 10.7 | -265.1 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-BB8 | | | **Date** | 06/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 69.8 degrees F and Mostly Cloudy. The wind is blowing E/SE at 9.2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 15:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:35 | **Volumes Purged** | | **Sample ID** | VRTB-L-BB8_06142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:30 | **Gallons Purged** | 2.11 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:00 | 0 | 0 | 200 | 0.00 | 0.26 | 7.36 | 0.445 | 2.44 | 0.29 | 13.2 | -69.7 | -- | -- |
| 16:05 | 5 | 5 | 200 | 0.00 | 0.53 | 7.22 | 0.377 | 1.74 | 0.49 | 12.9 | -59.1 | -- | -- |
| 16:10 | 5 | 10 | 200 | 0.00 | 0.79 | 7.23 | 0.364 | 1.67 | 0.65 | 12.7 | -58.3 | -- | -- |
| 16:15 | 5 | 15 | 200 | 0.00 | 1.06 | 7.24 | 0.356 | 1.56 | 0.77 | 12.6 | -58.6 | -- | -- |
| 16:20 | 5 | 20 | 200 | 0.00 | 1.32 | 7.25 | 0.351 | 1.5 | 0.83 | 12.5 | -56.8 | -- | -- |
| 16:25 | 5 | 25 | 200 | 0.00 | 1.59 | 7.26 | 0.344 | 1.24 | 0.87 | 12.4 | -54.6 | -- | -- |
| 16:30 | 5 | 30 | 200 | 0.00 | 1.85 | 7.26 | 0.345 | 1.19 | 0.9 | 12.4 | -53.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-G4 | | | **Date** | 06/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 69.8 degrees F and Mostly Cloudy. The wind is blowing E/SE at 9.2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 11:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:10 | **Volumes Purged** | | **Sample ID** | VRTB-L-G4_06142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:05 | **Gallons Purged** | 2.38 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:30 | 0 | 0 | 200 | 0.00 | 0.26 | 6.91 | 0.376 | 3.88 | 1.46 | 12.7 | -3.2 | -- | -- |
| 11:35 | 5 | 5 | 200 | 0.00 | 0.53 | 7.07 | 0.373 | 2.59 | 1.1 | 13 | -9.6 | -- | -- |
| 11:40 | 5 | 10 | 200 | 0.00 | 0.79 | 7.17 | 0.361 | 2.09 | 1.21 | 12.7 | -21.3 | -- | -- |
| 11:45 | 5 | 15 | 200 | 0.00 | 1.06 | 7.18 | 0.351 | 1.84 | 1.22 | 12.7 | -25 | -- | -- |
| 11:50 | 5 | 20 | 200 | 0.00 | 1.32 | 7.22 | 0.345 | 1.8 | 1.37 | 12.5 | -31.3 | -- | -- |
| 11:55 | 5 | 25 | 200 | 0.00 | 1.59 | 7.25 | 0.345 | 1.51 | 1.33 | 12.9 | -39.3 | -- | -- |
| 12:00 | 5 | 30 | 200 | 0.00 | 1.85 | 7.33 | 0.344 | 1.33 | 1.33 | 12.8 | -46.1 | -- | -- |
| 12:05 | 5 | 35 | 200 | 0.00 | 2.11 | 7.29 | 0.34 | 1.13 | 1.31 | 12.8 | -46.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-M5 | | | **Date** | 06/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 69.8 degrees F and Mostly Cloudy. The wind is blowing E/SE at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 12:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:45 | **Volumes Purged** | | **Sample ID** | VRTB-L-M5_06142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:40 | **Gallons Purged** | 3.43 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:20 | 0 | 0 | 200 | 0.00 | 2.11 | 7.29 | 0.441 | 1.44 | 0.18 | 13.1 | -66.7 | -- | -- |
| 13:25 | 5 | 5 | 200 | 0.00 | 2.38 | 7.31 | 0.431 | 1.2 | 0.17 | 13.1 | -72.1 | -- | -- |
| 13:30 | 5 | 10 | 200 | 0.00 | 2.64 | 7.3 | 0.421 | 1.02 | 0.18 | 13.1 | -72.5 | -- | -- |
| 13:35 | 5 | 15 | 200 | 0.00 | 2.91 | 7.31 | 0.416 | 0.79 | 0.18 | 13.1 | -77.6 | -- | -- |
| 13:40 | 5 | 20 | 200 | 0.00 | 3.17 | 7.32 | 0.409 | 0.71 | 0.19 | 13.2 | -80.8 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

| | |
|---|---|
| Well diameter (inches) = gallons per foot | 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47<br>1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65 |

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-O6 | | | **Date** | 06/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 69.8 degrees F and Mostly Cloudy. The wind is blowing E/SE at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 13:50 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:40 | **Volumes Purged** | | **Sample ID** | VRTB-L-O6_06142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:35 | **Gallons Purged** | 2.64 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:55 | 0 | 0 | 200 | 0.00 | 0.26 | 7.05 | 0.54 | 3.39 | 0.59 | 13 | -47.2 | -- | -- |
| 14:00 | 5 | 5 | 200 | 0.00 | 0.53 | 7.12 | 0.429 | 2.56 | 0.58 | 13 | -54.3 | -- | -- |
| 14:05 | 5 | 10 | 200 | 0.00 | 0.79 | 7.12 | 0.369 | 2.02 | 0.68 | 13 | -54.4 | -- | -- |
| 14:10 | 5 | 15 | 200 | 0.00 | 1.06 | 7.14 | 0.328 | 1.49 | 0.85 | 12.7 | -56.5 | -- | -- |
| 14:15 | 5 | 20 | 200 | 0.00 | 1.32 | 7.15 | 0.314 | 1.4 | 0.89 | 12.8 | -57.2 | -- | -- |
| 14:20 | 5 | 25 | 200 | 0.00 | 1.59 | 7.19 | 0.29 | 1.57 | 1.09 | 12.8 | -59.2 | -- | -- |
| 14:25 | 5 | 30 | 200 | 0.00 | 1.85 | 7.21 | 0.276 | 1.29 | 1.21 | 12.7 | -59.9 | -- | -- |
| 14:30 | 5 | 35 | 200 | 0.00 | 2.11 | 7.22 | 0.271 | 1.2 | 1.26 | 12.7 | -60.1 | -- | -- |
| 14:35 | 5 | 40 | 200 | 0.00 | 2.38 | 7.23 | 0.268 | 1.01 | 1.29 | 12.7 | -60.3 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-P7 | | | **Date** | 06/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 69.8 degrees F and Mostly Cloudy. The wind is blowing E/SE at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 14:50 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:50 | **Volumes Purged** | | **Sample ID** | VRTB-L-P7_06142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:45 | **Gallons Purged** | 3.17 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:55 | 0 | 0 | 200 | 0.00 | 0.26 | 6.78 | 2.12 | 4.75 | 0.22 | 13.8 | -18.7 | -- | -- |
| 15:00 | 5 | 5 | 200 | 0.00 | 0.53 | 6.75 | 2.02 | 3.37 | 0.25 | 13.7 | -25.4 | -- | -- |
| 15:05 | 5 | 10 | 200 | 0.00 | 0.79 | 6.79 | 1.82 | 3.03 | 0.19 | 13.3 | -37.9 | -- | -- |
| 15:10 | 5 | 15 | 200 | 0.00 | 1.06 | 6.8 | 1.7 | 2.47 | 0.18 | 13.2 | -45.6 | -- | -- |
| 15:15 | 5 | 20 | 200 | 0.00 | 1.32 | 6.82 | 1.62 | 2.03 | 0.2 | 13.1 | -50.4 | -- | -- |
| 15:20 | 5 | 25 | 200 | 0.00 | 1.59 | 6.83 | 1.55 | 1.64 | 0.21 | 12.9 | -52.6 | -- | -- |
| 15:25 | 5 | 30 | 200 | 0.00 | 1.85 | 6.83 | 1.51 | 1.34 | 0.19 | 13 | -56 | -- | -- |
| 15:30 | 5 | 35 | 200 | 0.00 | 2.11 | 6.88 | 1.42 | 1.3 | 0.22 | 12.9 | -62.3 | -- | -- |
| 15:35 | 5 | 40 | 200 | 0.00 | 2.38 | 6.89 | 1.38 | 1.12 | 0.23 | 13 | -64.4 | -- | -- |
| 15:40 | 5 | 45 | 200 | 0.00 | 2.64 | 6.9 | 1.37 | 1.04 | 0.22 | 13 | -67.8 | -- | -- |
| 15:45 | 5 | 50 | 200 | 0.00 | 2.91 | 6.92 | 1.34 | 0.84 | 0.21 | 12.9 | -69.5 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-S2 | | | **Date** | 06/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 71.6 degrees F and Mostly Cloudy. The wind is blowing S/SE at 6.9 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 09:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:30 | **Volumes Purged** | | **Sample ID** | VRTB-L-S2_06142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:25 | **Gallons Purged** | 3.43 | **Replicate/ Code No.** | Dup-02_06142022 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:30 | 0 | 0 | 200 | 0.00 | 0.26 | 9.4 | 1.55 | 8.58 | 0.23 | 11 | -122.5 | -- | -- |
| 09:35 | 5 | 5 | 200 | 0.00 | 0.53 | 9.16 | 1.36 | 4.14 | 0.13 | 10.9 | -127.4 | -- | -- |
| 09:40 | 5 | 10 | 200 | 0.00 | 0.79 | 8.99 | 1.24 | 1.66 | 0.16 | 10.9 | -132.6 | -- | -- |
| 09:45 | 5 | 15 | 200 | 0.00 | 1.06 | 8.78 | 1.14 | 1.6 | 0.12 | 11.1 | -142.2 | -- | -- |
| 09:50 | 5 | 20 | 200 | 0.00 | 1.32 | 8.65 | 1.14 | 1.06 | 0.12 | 11 | -147.4 | -- | -- |
| 09:55 | 5 | 25 | 200 | 0.00 | 1.59 | 8.55 | 1.06 | 0.73 | 0.15 | 11.1 | -152.4 | -- | -- |
| 10:00 | 5 | 30 | 200 | 0.00 | 1.85 | 8.47 | 1.03 | 1.12 | 0.1 | 11.1 | -156.6 | -- | -- |
| 10:05 | 5 | 35 | 200 | 0.00 | 2.11 | 8.37 | 0.98 | 1.18 | 0.15 | 11.5 | -166.7 | -- | -- |
| 10:10 | 5 | 40 | 200 | 0.00 | 2.38 | 8.33 | 0.95 | 0.98 | 0.14 | 11.9 | -171.3 | -- | -- |
| 10:15 | 5 | 45 | 200 | 0.00 | 2.64 | 8.29 | 0.9 | 0.9 | 0.15 | 11.6 | -176 | -- | -- |
| 10:20 | 5 | 50 | 200 | 0.00 | 2.91 | 8.24 | 0.89 | 0.87 | 0.16 | 11.8 | -176.5 | -- | -- |
| 10:25 | 5 | 55 | 200 | 0.00 | 3.17 | 8.23 | 0.89 | 0.8 | 0.16 | 11.6 | -176.8 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-Y3 | | | **Date** | 06/14/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 69.8 degrees F and Mostly Cloudy. The wind is blowing E/SE at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 10:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:20 | **Volumes Purged** | | **Sample ID** | VRTB-L-Y3_06142022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:15 | **Gallons Purged** | 2.11 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:45 | 0 | 0 | 200 | 0.00 | 0.26 | 7.04 | 0.77 | 4.33 | 4.52 | 12.3 | -64.1 | -- | -- |
| 10:50 | 5 | 5 | 200 | 0.00 | 0.53 | 7.23 | 0.332 | 2.61 | 5.15 | 12 | -51.4 | -- | -- |
| 10:55 | 5 | 10 | 200 | 0.00 | 0.79 | 7.23 | 0.273 | 2.32 | 5.08 | 11.9 | -39.1 | -- | -- |
| 11:00 | 5 | 15 | 200 | 0.00 | 1.06 | 7.28 | 0.25 | 2.02 | 5.17 | 12 | -33.8 | -- | -- |
| 11:05 | 5 | 20 | 200 | 0.00 | 1.32 | 7.35 | 0.233 | 1.77 | 5.2 | 12.1 | -29.1 | -- | -- |
| 11:10 | 5 | 25 | 200 | 0.00 | 1.59 | 7.36 | 0.229 | 1.51 | 5.35 | 12.1 | -26.6 | -- | -- |
| 11:15 | 5 | 30 | 200 | 0.00 | 1.85 | 7.4 | 0.227 | 1.29 | 5.38 | 12 | -24.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-B1 | | | **Date** | 06/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 64.4 degrees F and Cloudy. The wind is blowing SW at 9.2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 16:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:35 | **Volumes Purged** | | **Sample ID** | VRTB-S-B1_06132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:30 | **Gallons Purged** | 2.91 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:45 | 0 | 0 | 200 | 0.00 | 0.26 | 7.14 | 1.09 | 5.81 | 0.34 | 11.5 | -19.7 | -- | -- |
| 16:50 | 5 | 5 | 200 | 0.00 | 0.53 | 7.15 | 1.02 | 2.8 | 0.51 | 11.2 | -23 | -- | -- |
| 16:55 | 5 | 10 | 200 | 0.00 | 0.79 | 7.15 | 0.94 | 2.11 | 0.63 | 11.2 | -24 | -- | -- |
| 17:00 | 5 | 15 | 200 | 0.00 | 1.06 | 7.16 | 0.91 | 1.71 | 0.74 | 11.3 | -24.5 | -- | -- |
| 17:05 | 5 | 20 | 200 | 0.00 | 1.32 | 7.19 | 0.86 | 1.4 | 0.86 | 11.5 | -25.6 | -- | -- |
| 17:10 | 5 | 25 | 200 | 0.00 | 1.59 | 7.23 | 0.79 | 1.13 | 1.13 | 11.2 | -26.3 | -- | -- |
| 17:15 | 5 | 30 | 200 | 0.00 | 1.85 | 7.22 | 0.78 | 0.76 | 1.37 | 11.3 | -24.8 | -- | -- |
| 17:20 | 5 | 35 | 200 | 0.00 | 2.11 | 7.24 | 0.74 | 0.96 | 1.41 | 11.2 | -24.2 | -- | -- |
| 17:25 | 5 | 40 | 200 | 0.00 | 2.38 | 7.24 | 0.72 | 1.22 | 1.43 | 11.2 | -23.5 | -- | -- |
| 17:30 | 5 | 45 | 200 | 0.00 | 2.64 | 7.24 | 0.72 | 1.34 | 1.47 | 11.2 | -22.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | HCL |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-G4 | | | **Date** | 06/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 71.6 degrees F and Mostly Cloudy. The wind is blowing S/SE at 6.9 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 19:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 19:50 | **Volumes Purged** | | **Sample ID** | VRTB-S-G4_06132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 19:45 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 19:20 | 0 | 0 | 200 | 0.00 | 0.26 | 7.71 | 0.254 | 4.43 | 8.62 | 12 | -74.1 | -- | -- |
| 19:25 | 5 | 5 | 200 | 0.00 | 0.53 | 7.69 | 0.425 | 3.47 | 1.58 | 11.7 | 1.8 | -- | -- |
| 19:30 | 5 | 10 | 200 | 0.00 | 0.79 | 7.86 | 0.53 | 2.42 | 1.72 | 11.3 | 0.3 | -- | -- |
| 19:35 | 5 | 15 | 200 | 0.00 | 1.06 | 7.85 | 0.53 | 2.22 | 1.84 | 11.3 | 1 | -- | -- |
| 19:40 | 5 | 20 | 200 | 0.00 | 1.32 | 7.91 | 0.53 | 1.84 | 1.91 | 11.4 | 0.7 | -- | -- |
| 19:45 | 5 | 25 | 200 | 0.00 | 1.59 | 7.93 | 0.54 | 1.5 | 2.01 | 11.2 | 0.1 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-M5 | | | **Date** | 06/16/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 76 °F, Sunny, winds at mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 08:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:10 | **Volumes Purged** | | **Sample ID** | VRTB-S-M5_06162022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:05 | **Gallons Purged** | 2.38 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:30 | 0 | 0 | 200 | 0.00 | 0.26 | 6.64 | 0.6 | 2.08 | 4.75 | 13.9 | 167.2 | -- | -- |
| 08:35 | 5 | 5 | 200 | 0.00 | 0.53 | 6.86 | 0.57 | 1.71 | 4.63 | 13.8 | 157.4 | -- | -- |
| 08:40 | 5 | 10 | 200 | 0.00 | 0.79 | 7.11 | 0.496 | 1.43 | 2.36 | 13.6 | 149.3 | -- | -- |
| 08:45 | 5 | 15 | 200 | 0.00 | 1.06 | 7.11 | 0.492 | 1.4 | 2.33 | 13.6 | 149.8 | -- | -- |
| 08:50 | 5 | 20 | 200 | 0.00 | 1.32 | 7.37 | 0.52 | 1.31 | 3.68 | 13.4 | 149.1 | -- | -- |
| 08:55 | 5 | 25 | 200 | 0.00 | 1.59 | 7.42 | 0.51 | 1.22 | 4.35 | 13.5 | 145.5 | -- | -- |
| 09:00 | 5 | 30 | 200 | 0.00 | 1.85 | 7.45 | 0.5 | 1.11 | 4.45 | 13.5 | 143.7 | -- | -- |
| 09:05 | 5 | 35 | 200 | 0.00 | 2.11 | 7.46 | 0.495 | 1.07 | 4.49 | 13.6 | 141.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |
| Total Organic Carbon | 250mL HDPE Plastic | 1 | H2SO4 |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-O6 | | | **Date** | 06/16/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Sunny, winds at mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 09:20 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:30 | **Volumes Purged** | | **Sample ID** | VRTB-S-O6_06162022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:25 | **Gallons Purged** | 3.70 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:25 | 0 | 0 | 200 | 0.00 | 0.26 | 7.08 | 0.65 | 2.47 | 4.59 | 15.5 | 141.9 | -- | -- |
| 09:30 | 5 | 5 | 200 | 0.00 | 0.53 | 7.04 | 0.82 | 2.15 | 0.69 | 14.9 | 155.6 | -- | -- |
| 09:35 | 5 | 10 | 200 | 0.00 | 0.79 | 7.36 | 0.79 | 1.66 | 1.1 | 14.8 | 149.6 | -- | -- |
| 09:40 | 5 | 15 | 200 | 0.00 | 1.06 | 7.41 | 0.75 | 1.41 | 1.47 | 14.8 | 147 | -- | -- |
| 09:45 | 5 | 20 | 200 | 0.00 | 1.32 | 7.47 | 0.65 | 1.29 | 1.89 | 14.6 | 142.8 | -- | -- |
| 09:50 | 5 | 25 | 200 | 0.00 | 1.59 | 7.49 | 0.59 | 1.22 | 2.85 | 14.4 | 140.9 | -- | -- |
| 09:55 | 5 | 30 | 200 | 0.00 | 1.85 | 7.55 | 0.52 | 1.08 | 3.31 | 14.8 | 136.6 | -- | -- |
| 10:00 | 5 | 35 | 200 | 0.00 | 2.11 | 7.63 | 0.491 | 0.92 | 3.31 | 15.2 | 130.6 | -- | -- |
| 10:05 | 5 | 40 | 200 | 0.00 | 2.38 | 7.1 | 0.47 | 0.81 | 3.39 | 15.8 | 126.7 | -- | -- |
| 10:10 | 5 | 45 | 200 | 0.00 | 2.64 | 7.76 | 0.46 | 0.98 | 3.65 | 16.5 | 123.7 | -- | -- |
| 10:15 | 5 | 50 | 200 | 0.00 | 2.91 | 7.79 | 0.45 | 1.13 | 3.53 | 16.4 | 121.4 | -- | -- |
| 10:20 | 5 | 55 | 200 | 0.00 | 3.17 | 7.82 | 0.441 | 1.07 | 3.84 | 16.3 | 119.1 | -- | -- |
| 10:25 | 5 | 60 | 200 | 0.00 | 3.43 | 7.81 | 0.44 | 0.95 | 3.86 | 16.2 | 119.6 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-P8 | | | **Date** | 06/16/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Sunny, winds at mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 11:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:20 | **Volumes Purged** | | **Sample ID** | VRTB-S-P8_06162022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:15 | **Gallons Purged** | 2.38 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:40 | 0 | 0 | 200 | 0.00 | 0.26 | 11.86 | 1.85 | 4.68 | 3.73 | 16.3 | 130.4 | -- | -- |
| 11:45 | 5 | 5 | 200 | 0.00 | 0.53 | 11.67 | 1.74 | 3.11 | 4.41 | 17 | 130.3 | -- | -- |
| 11:50 | 5 | 10 | 200 | 0.00 | 0.79 | 11.62 | 1.29 | 2.85 | 4.73 | 16.4 | 125.6 | -- | -- |
| 11:55 | 5 | 15 | 200 | 0.00 | 1.06 | 11.58 | 1.22 | 2.47 | 4.91 | 16.7 | 124.9 | -- | -- |
| 12:00 | 5 | 20 | 200 | 0.00 | 1.32 | 11.63 | 1.17 | 2.06 | 5.35 | 16.4 | 121.5 | -- | -- |
| 12:05 | 5 | 25 | 200 | 0.00 | 1.59 | 11.52 | 1.13 | 1.81 | 6.31 | 16.4 | 122.6 | -- | -- |
| 12:10 | 5 | 30 | 200 | 0.00 | 1.85 | 11.47 | 1.12 | 1.54 | 6.53 | 16.5 | 121 | -- | -- |
| 12:15 | 5 | 35 | 200 | 0.00 | 2.11 | 11.43 | 1.12 | 1.49 | 6.76 | 16.6 | 118.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | H2SO4 |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-R7 | | | **Date** | 06/16/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Sunny, winds at mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 10:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:25 | **Volumes Purged** | | **Sample ID** | VRTB-S-R7_06162022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:20 | **Gallons Purged** | 2.11 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:50 | 0 | 0 | 200 | 0.00 | 0.26 | 6.7 | 3.47 | 3.09 | 2.87 | 14.7 | 159.4 | -- | -- |
| 10:55 | 5 | 5 | 200 | 0.00 | 0.53 | 6.77 | 2.89 | 2.54 | 2.06 | 14.8 | 153.5 | -- | -- |
| 11:00 | 5 | 10 | 200 | 0.00 | 0.79 | 6.82 | 2.64 | 2.04 | 1.81 | 14.6 | 148.3 | -- | -- |
| 11:05 | 5 | 15 | 200 | 0.00 | 1.06 | 6.84 | 2.44 | 1.74 | 1.72 | 14.7 | 144.9 | -- | -- |
| 11:10 | 5 | 20 | 200 | 0.00 | 1.32 | 6.84 | 2.41 | 1.62 | 1.73 | 14.5 | 143.9 | -- | -- |
| 11:15 | 5 | 25 | 200 | 0.00 | 1.59 | 6.86 | 2.36 | 1.43 | 1.68 | 14.6 | 140.6 | -- | -- |
| 11:20 | 5 | 30 | 200 | 0.00 | 1.85 | 6.91 | 2.34 | 1.13 | 1.7 | 14.7 | 135.3 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |
| Total Organic Carbon | 250mL HDPE Plastic | 1 | H2SO4 |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-S2 | | | **Date** | 06/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 71.6 degrees F and Mostly Cloudy. The wind is blowing S/SE at 6.9 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 17:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:30 | **Volumes Purged** | | **Sample ID** | VRTB-S-S2_06132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:25 | **Gallons Purged** | 2.38 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:50 | 0 | 0 | 200 | 0.00 | 0.26 | 7.4 | 0.376 | 126 | 3.85 | 14.8 | -10.3 | -- | -- |
| 17:55 | 5 | 5 | 200 | 0.00 | 0.53 | 7.57 | 0.72 | 105 | 0.81 | 11.9 | 4.8 | -- | -- |
| 18:00 | 5 | 10 | 200 | 0.00 | 0.79 | 7.36 | 0.56 | 59.8 | 2.45 | 11.5 | 6.5 | -- | -- |
| 18:05 | 5 | 15 | 200 | 0.00 | 1.06 | 7.32 | 0.52 | 32.5 | 2.89 | 11.6 | 6 | -- | -- |
| 18:10 | 5 | 20 | 200 | 0.00 | 1.32 | 7.29 | 0.474 | 21.1 | 3.1 | 11.4 | 4.7 | -- | -- |
| 18:15 | 5 | 25 | 200 | 0.00 | 1.59 | 7.29 | 0.456 | 12.3 | 3.72 | 11.4 | 4.1 | -- | -- |
| 18:20 | 5 | 30 | 200 | 0.00 | 1.85 | 7.3 | 0.451 | 11.8 | 3.77 | 11.3 | 4 | -- | -- |
| 18:25 | 5 | 35 | 200 | 0.00 | 2.11 | 7.3 | 0.447 | 11.2 | 3.8 | 11.2 | 3.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-Y3 | | | **Date** | 06/13/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 71.6 degrees F and Mostly Cloudy. The wind is blowing S/SE at 6.9 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 18:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 19:10 | **Volumes Purged** | | **Sample ID** | VRTB-S-Y3_06132022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 19:05 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:40 | 0 | 0 | 200 | 0.00 | 0.26 | 7.6 | 0.255 | 6.62 | 7.76 | 13 | -36.1 | -- | -- |
| 18:45 | 5 | 5 | 200 | 0.00 | 0.53 | 7.35 | 1.08 | 3.48 | 2.03 | 11.1 | 29.1 | -- | -- |
| 18:50 | 5 | 10 | 200 | 0.00 | 0.79 | 7.29 | 1.08 | 2.04 | 1.86 | 11.1 | 19.7 | -- | -- |
| 18:55 | 5 | 15 | 200 | 0.00 | 1.06 | 7.27 | 1.06 | 1.71 | 1.86 | 11.1 | 9.3 | -- | -- |
| 19:00 | 5 | 20 | 200 | 0.00 | 1.32 | 7.27 | 1.04 | 1.44 | 1.9 | 11 | 4.2 | -- | -- |
| 19:05 | 5 | 25 | 200 | 0.00 | 1.59 | 7.26 | 1.03 | 1.14 | 1.95 | 10.9 | 2.1 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Logs

# Performance Monitoring Event #4

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_2 | | | **Date** | 08/25/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 70 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 16.42 | **Total Depth (ft-bmp)** | 16.6 | **Water Column (ft)** | 0.18 | **Gallons in Well** | |
| **Purge Start** | 08:40 | **Pump Intake (ft-bmp)** | 16.55 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:10 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_2_08252022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:05 | **Gallons Purged** | 1.59 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:50 | 0 | 0 | 200 | 16.42 | 0.53 | 7.58 | 0.261 | 3.68 | 1.04 | 12.4 | 41.6 | -- | -- |
| 08:55 | 5 | 5 | 200 | 16.42 | 0.79 | 7.57 | 0.261 | 3.22 | 1.03 | 12.3 | 44.8 | -- | -- |
| 09:00 | 5 | 10 | 200 | 16.42 | 1.06 | 7.57 | 0.26 | 2.79 | 1.03 | 12.4 | 46.6 | -- | -- |
| 09:05 | 5 | 15 | 200 | 16.42 | 1.32 | 7.57 | 0.259 | 2.23 | 1.06 | 12.3 | 49.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_3 | | | **Date** | 08/25/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 70 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 16.42 | **Total Depth (ft-bmp)** | 19.5 | **Water Column (ft)** | 3.08 | **Gallons in Well** | |
| **Purge Start** | 09:30 | **Pump Intake (ft-bmp)** | 19.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:00 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_3_08252022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:55 | **Gallons Purged** | 1.59 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:35 | 0 | 0 | 200 | | 0.26 | 7.76 | 0.228 | 9.72 | 9 | 11.9 | 74.9 | -- | -- |
| 09:40 | 5 | 5 | 200 | | 0.53 | 7.75 | 0.228 | 3.9 | 9.08 | 11.9 | 77.3 | -- | -- |
| 09:45 | 5 | 10 | 200 | | 0.79 | 7.76 | 0.228 | 2.88 | 9.06 | 11.9 | 78.8 | -- | -- |
| 09:50 | 5 | 15 | 200 | | 1.06 | 7.76 | 0.227 | 2.43 | 9.14 | 11.8 | 80.4 | -- | -- |
| 09:55 | 5 | 20 | 200 | | 1.32 | 7.76 | 0.228 | 2.23 | 9.12 | 11.9 | 81.8 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_4 | | | **Date** | 08/25/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 70 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 16.42 | **Total Depth (ft-bmp)** | 23 | **Water Column (ft)** | 6.58 | **Gallons in Well** | |
| **Purge Start** | 10:10 | **Pump Intake (ft-bmp)** | 23 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:40 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_4_08252022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:35 | **Gallons Purged** | 1.59 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:15 | 0 | 0 | 200 | 16.42 | 0.26 | 7.79 | 0.223 | 6.15 | 9.11 | 11.6 | 81.6 | -- | -- |
| 10:25 | 10 | 10 | 200 | 16.42 | 0.79 | 7.79 | 0.223 | 2.58 | 9.12 | 11.6 | 85.2 | -- | -- |
| 10:30 | 5 | 15 | 200 | 16.42 | 1.06 | 7.79 | 0.223 | 2.39 | 9.06 | 11.6 | 86.2 | -- | -- |
| 10:35 | 5 | 20 | 200 | 16.42 | 1.32 | 7.8 | 0.224 | 2.3 | 9.12 | 11.7 | 87.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_5 | | | **Date** | 08/25/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 70 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 16.42 | **Total Depth (ft-bmp)** | 26.5 | **Water Column (ft)** | 10.08 | **Gallons in Well** | |
| **Purge Start** | 10:45 | **Pump Intake (ft-bmp)** | 26.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:15 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_5_08252022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:10 | **Gallons Purged** | 1.59 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:55 | 0 | 0 | 200 | 16.42 | 0.53 | 7.83 | 0.215 | 4.86 | 9.16 | 11.4 | 84.4 | -- | -- |
| 11:00 | 5 | 5 | 200 | 16.42 | 0.79 | 7.84 | 0.214 | 2.48 | 9.18 | 11.3 | 86.1 | -- | -- |
| 11:05 | 5 | 10 | 200 | 16.42 | 1.06 | 7.84 | 0.214 | 2.13 | 9.21 | 11.2 | 87.5 | -- | -- |
| 11:10 | 5 | 15 | 200 | 16.42 | 1.32 | 7.84 | 0.215 | 1.71 | 9.31 | 11.2 | 88.5 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_6 | | | **Date** | 08/25/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 70 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 16.42 | **Total Depth (ft-bmp)** | 30.5 | **Water Column (ft)** | 14.08 | **Gallons in Well** | |
| **Purge Start** | 11:20 | **Pump Intake (ft-bmp)** | 30.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:45 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_6_08252022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:40 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:25 | 0 | 0 | 200 | 16.42 | 0.26 | 8.03 | 0.185 | 11.03 | 9.25 | 11.4 | 80.3 | -- | -- |
| 11:30 | 5 | 5 | 200 | 16.42 | 0.53 | 8.03 | 0.184 | 2.77 | 9.26 | 11.4 | 81.4 | -- | -- |
| 11:35 | 5 | 10 | 200 | 16.42 | 0.79 | 8.04 | 0.184 | 2.39 | 9.35 | 11.4 | 83.2 | -- | -- |
| 11:40 | 5 | 15 | 200 | 16.42 | 1.06 | 8.04 | 0.184 | 2.2 | 9.37 | 11.4 | 83.8 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_7 | | | **Date** | 08/25/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 70 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 16.42 | **Total Depth (ft-bmp)** | 36.5 | **Water Column (ft)** | 20.08 | **Gallons in Well** | |
| **Purge Start** | 11:50 | **Pump Intake (ft-bmp)** | 36.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:15 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_7_08252022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:10 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:55 | 0 | 0 | 200 | 16.42 | 0.26 | 8.19 | 0.119 | 3.58 | 9.04 | 11.4 | 73.4 | -- | -- |
| 12:00 | 5 | 5 | 200 | 16.42 | 0.53 | 8.2 | 0.119 | 1.94 | 9.1 | 11.4 | 74.7 | -- | -- |
| 12:05 | 5 | 10 | 200 | 16.42 | 0.79 | 8.2 | 0.119 | 1.63 | 9.04 | 11.3 | 76.7 | -- | -- |
| 12:10 | 5 | 15 | 200 | 16.42 | 1.06 | 8.21 | 0.119 | 1.51 | 9.12 | 11.2 | 78 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-1D | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.10 | **Total Depth (ft-bmp)** | 30.28 | **Water Column (ft)** | 15.18 | **Gallons in Well** | 2.47 |
| **Purge Start** | 17:10 | **Pump Intake (ft-bmp)** | 27.78 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:35 | **Volumes Purged** | 0.53 | **Sample ID** | MW-VRTB-1D_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:30 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:15 | 0 | 0 | 200 | 15.10 | 0.26 | 7.97 | 0.198 | 4.37 | 9.18 | 12.8 | 19.4 | -- | -- |
| 17:20 | 5 | 5 | 200 | 15.10 | 0.53 | 7.96 | 0.192 | 2.19 | 9.26 | 12.2 | 33.6 | -- | -- |
| 17:25 | 5 | 10 | 200 | 15.10 | 0.79 | 7.95 | 0.197 | 2.02 | 9.25 | 12.5 | 36.6 | -- | -- |
| 17:30 | 5 | 15 | 200 | 15.10 | 1.06 | 7.94 | 0.197 | 1.64 | 9.24 | 12.4 | 41.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-1S | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 14.77 | **Total Depth (ft-bmp)** | 19.47 | **Water Column (ft)** | 4.7 | **Gallons in Well** | 0.76 |
| **Purge Start** | 16:35 | **Pump Intake (ft-bmp)** | 16.97 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:00 | **Volumes Purged** | 1.74 | **Sample ID** | MW-VRTB-1S_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:55 | **Gallons Purged** | 1.32 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:40 | 0 | 0 | 200 | 14.77 | 0.26 | 7.77 | 0.258 | 3.44 | 4.96 | 14 | -7.8 | -- | -- |
| 16:45 | 5 | 5 | 200 | 14.77 | 0.53 | 7.63 | 0.253 | 3.23 | 5.23 | 13.8 | -56.4 | -- | -- |
| 16:50 | 5 | 10 | 200 | 14.77 | 0.79 | 7.6 | 0.253 | 2.88 | 5.14 | 13.7 | -64.7 | -- | -- |
| 16:55 | 5 | 15 | 200 | 14.77 | 1.06 | 7.59 | 0.252 | 2.68 | 5.21 | 13.4 | -65.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-2D | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.08 | **Total Depth (ft-bmp)** | 30.42 | **Water Column (ft)** | 15.34 | **Gallons in Well** | 2.49 |
| **Purge Start** | 18:25 | **Pump Intake (ft-bmp)** | 27.92 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:55 | **Volumes Purged** | 0.64 | **Sample ID** | MW-VRTB-2D_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:50 | **Gallons Purged** | 1.59 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:30 | 0 | 0 | 200 | 15.08 | 0.26 | 7.73 | 0.311 | 4.51 | 4.69 | 12.7 | 49.2 | -- | -- |
| 18:35 | 5 | 5 | 200 | 15.08 | 0.53 | 7.73 | 0.312 | 3.44 | 4.62 | 12.8 | 49.5 | -- | -- |
| 18:40 | 5 | 10 | 200 | 15.08 | 0.79 | 7.72 | 0.309 | 2.59 | 4.56 | 12.5 | 52.7 | -- | -- |
| 18:45 | 5 | 15 | 200 | 15.08 | 1.06 | 7.72 | 0.309 | 2.14 | 4.66 | 12.6 | 55 | -- | -- |
| 18:50 | 5 | 20 | 200 | 15.08 | 1.32 | 7.72 | 0.307 | 1.69 | 4.71 | 12.5 | 56 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-2S | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.11 | **Total Depth (ft-bmp)** | 20.5 | **Water Column (ft)** | 5.39 | **Gallons in Well** | 0.88 |
| **Purge Start** | 17:50 | **Pump Intake (ft-bmp)** | 18 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:20 | **Volumes Purged** | 1.80 | **Sample ID** | MW-VRTB-2S_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:15 | **Gallons Purged** | 1.59 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:55 | 0 | 0 | 200 | 15.11 | 0.26 | 7.82 | 0.202 | 2.8 | 3.59 | 12.7 | 33 | -- | -- |
| 18:00 | 5 | 5 | 200 | 15.11 | 0.53 | 7.85 | 0.196 | 1.65 | 4.38 | 12.6 | 30.5 | -- | -- |
| 18:05 | 5 | 10 | 200 | 15.11 | 0.79 | 7.85 | 0.194 | 1.47 | 4.61 | 12.3 | 30.5 | -- | -- |
| 18:10 | 5 | 15 | 200 | 15.11 | 1.06 | 7.85 | 0.192 | 1.4 | 4.68 | 12.1 | 31.5 | -- | -- |
| 18:15 | 5 | 20 | 200 | 15.11 | 1.32 | 7.84 | 0.192 | 1.12 | 4.85 | 12.1 | 31.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | MW-VRTB-3 | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 2 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 14.85 | **Total Depth (ft-bmp)** | 19.55 | **Water Column (ft)** | 4.7 | **Gallons in Well** | 0.76 |
| **Purge Start** | 19:10 | **Pump Intake (ft-bmp)** | 17.05 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 19:45 | **Volumes Purged** | 2.43 | **Sample ID** | MW-VRTB-3_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 19:40 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 19:30 | 0 | 0 | 200 | 14.85 | 1.06 | 7.76 | 0.32 | 2.86 | 9.44 | 12.3 | 43.2 | -- | -- |
| 19:35 | 5 | 5 | 200 | 14.85 | 1.32 | 7.76 | 0.321 | 2.35 | 9.51 | 12.4 | 45.9 | -- | -- |
| 19:40 | 5 | 10 | 200 | 14.85 | 1.59 | 7.76 | 0.323 | 2.07 | 9.48 | 12.3 | 46.3 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-B1 | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 65 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 08:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:20 | **Volumes Purged** | | **Sample ID** | VRTB-D-B1_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:15 | **Gallons Purged** | 3.43 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:20 | 0 | 0 | 200 | 0.00 | 0.26 | 12.14 | 2.373 | 24.12 | 0.87 | 14.4 | -120.7 | -- | -- |
| 08:25 | 5 | 5 | 200 | 0.00 | 0.53 | 12.02 | 1.56 | 11.67 | 0.6 | 14.1 | -124.2 | -- | -- |
| 08:30 | 5 | 10 | 200 | 0.00 | 0.79 | 11.98 | 1.35 | 4.33 | 0.63 | 14.1 | -125.5 | -- | -- |
| 08:35 | 5 | 15 | 200 | 0.00 | 1.06 | 11.82 | 1.3 | 2.89 | 1.32 | 14.1 | -120.5 | -- | -- |
| 08:40 | 5 | 20 | 200 | 0.00 | 1.32 | 11.65 | 0.781 | 2.66 | 2.08 | 14 | -112.8 | -- | -- |
| 08:45 | 5 | 25 | 200 | 0.00 | 1.59 | 11.5 | 0.667 | 2.35 | 2.74 | 13.8 | -104.9 | -- | -- |
| 08:50 | 5 | 30 | 200 | 0.00 | 1.85 | 11.33 | 0.58 | 2.13 | 3.26 | 13.8 | -96.5 | -- | -- |
| 08:55 | 5 | 35 | 200 | 0.00 | 2.11 | 11.2 | 0.533 | 2.01 | 3.59 | 13.8 | -90.8 | -- | -- |
| 09:00 | 5 | 40 | 200 | 0.00 | 2.38 | 11 | 0.481 | 1.94 | 3.97 | 13.9 | -82.6 | -- | -- |
| 09:05 | 5 | 45 | 200 | 0.00 | 2.64 | 10.87 | 0.456 | 1.55 | 4.22 | 14 | -76.9 | -- | -- |
| 09:10 | 5 | 50 | 200 | 0.00 | 2.91 | 10.85 | 0.451 | 1.51 | 4.26 | 14.1 | -76.1 | -- | -- |
| 09:15 | 5 | 55 | 200 | 0.00 | 3.17 | 10.77 | 0.459 | 1.32 | 4.29 | 13.9 | -71.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-G4 | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 75 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 10:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:35 | **Volumes Purged** | | **Sample ID** | VRTB-D-G4_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:30 | **Gallons Purged** | 2.11 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:00 | 0 | 0 | 200 | 0.00 | 0.26 | 6.52 | 0.326 | 6.81 | 3.04 | 16.2 | 6.2 | -- | -- |
| 11:05 | 5 | 5 | 200 | 0.00 | 0.53 | 7.32 | 0.44 | 4.09 | 0.16 | 14.9 | -108.7 | -- | -- |
| 11:10 | 5 | 10 | 200 | 0.00 | 0.79 | 7.39 | 0.373 | 2.57 | 1.05 | 15.1 | -114.7 | -- | -- |
| 11:15 | 5 | 15 | 200 | 0.00 | 1.06 | 7.42 | 0.335 | 2.09 | 1.85 | 14.7 | -111.2 | -- | -- |
| 11:20 | 5 | 20 | 200 | 0.00 | 1.32 | 7.45 | 0.316 | 1.77 | 2.38 | 14.9 | -107.5 | -- | -- |
| 11:25 | 5 | 25 | 200 | 0.00 | 1.59 | 7.48 | 0.308 | 1.7 | 2.54 | 15 | -104.6 | -- | -- |
| 11:30 | 5 | 30 | 200 | 0.00 | 1.85 | 7.48 | 0.307 | 1.54 | 2.59 | 15 | -103.1 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-M5 | | | **Date** | 08/22/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 71.8 degrees F and Clear. The wind is blowing N at 9.2 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 12:50 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:35 | **Volumes Purged** | | **Sample ID** | VRTB-D-M5_08222022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:30 | **Gallons Purged** | 2.38 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:55 | 0 | 0 | 200 | 0.00 | 0.26 | 7.1 | 1.052 | 6.22 | 3.48 | 17.1 | -48.4 | -- | -- |
| 13:00 | 5 | 5 | 200 | 0.00 | 0.53 | 7.48 | 0.85 | 5.84 | 3.05 | 16.8 | -99.6 | -- | -- |
| 13:05 | 5 | 10 | 200 | 0.00 | 0.79 | 7.69 | 0.7 | 5.55 | 1.72 | 16.6 | -117.7 | -- | -- |
| 13:10 | 5 | 15 | 200 | 0.00 | 1.06 | 7.84 | 0.562 | 5.14 | 0.77 | 16.5 | -129.5 | -- | -- |
| 13:15 | 5 | 20 | 200 | 0.00 | 1.32 | 7.86 | 0.515 | 4.79 | 0.79 | 16.5 | -125.7 | -- | -- |
| 13:20 | 5 | 25 | 200 | 0.00 | 1.59 | 7.92 | 0.455 | 4.51 | 0.77 | 16.5 | -106.3 | -- | -- |
| 13:25 | 5 | 30 | 200 | 0.00 | 1.85 | 7.94 | 0.449 | 4.14 | 0.75 | 16.3 | -102.1 | -- | -- |
| 13:30 | 5 | 35 | 200 | 0.00 | 2.11 | 7.95 | 0.442 | 4.01 | 0.73 | 16.1 | -98.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-O6 | | | **Date** | 08/22/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 74.3 degrees F and Clear. The wind is blowing NW at 4.7 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 14:05 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:05 | **Volumes Purged** | | **Sample ID** | VRTB-D-O6_08222022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:00 | **Gallons Purged** | 3.17 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:10 | 0 | 0 | 200 | 0.00 | 0.26 | 6.95 | 1.375 | 22.52 | 3.08 | 16.3 | -76.5 | -- | -- |
| 14:15 | 5 | 5 | 200 | 0.00 | 0.53 | 6.95 | 1.345 | 16.78 | 2.43 | 16.5 | -85.9 | -- | -- |
| 14:20 | 5 | 10 | 200 | 0.00 | 0.79 | 6.99 | 1.149 | 11.44 | 1.08 | 16.1 | -86.4 | -- | -- |
| 14:25 | 5 | 15 | 200 | 0.00 | 1.06 | 6.99 | 0.959 | 9.45 | 0.59 | 15.8 | -88.4 | -- | -- |
| 14:30 | 5 | 20 | 200 | 0.00 | 1.32 | 7.02 | 0.751 | 6.52 | 0.81 | 15.9 | -82.1 | -- | -- |
| 14:35 | 5 | 25 | 200 | 0.00 | 1.59 | 7.06 | 0.679 | 4.85 | 1.09 | 15.9 | -77.3 | -- | -- |
| 14:40 | 5 | 30 | 200 | 0.00 | 1.85 | 7.09 | 0.623 | 4.11 | 1.4 | 15.8 | -72.1 | -- | -- |
| 14:45 | 5 | 35 | 200 | 0.00 | 2.11 | 7.12 | 0.574 | 3.72 | 1.75 | 15.7 | -67.9 | -- | -- |
| 14:50 | 5 | 40 | 200 | 0.00 | 2.38 | 7.14 | 0.556 | 3.61 | 1.77 | 15.8 | -64.9 | -- | -- |
| 14:55 | 5 | 45 | 200 | 0.00 | 2.64 | 7.15 | 0.551 | 3.39 | 1.79 | 15.8 | -63.8 | -- | -- |
| 15:00 | 5 | 50 | 200 | 0.00 | 2.91 | 7.17 | 0.54 | 3.21 | 1.89 | 16 | -64 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-P8 | | | **Date** | 08/22/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 78.1 degrees F and Clear. The wind is blowing N at 10.3 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 16:20 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:10 | **Volumes Purged** | | **Sample ID** | VRTB-D-P8_08222022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:05 | **Gallons Purged** | 2.64 | **Replicate/ Code No.** | Dup-01_08222022 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:25 | 0 | 0 | 200 | 0.00 | 0.26 | 11.88 | 1.224 | 9.62 | 2.52 | 15.8 | -106.7 | -- | -- |
| 16:30 | 5 | 5 | 200 | 0.00 | 0.53 | 11.69 | 0.792 | 4.31 | 3.59 | 15.7 | -100.1 | -- | -- |
| 16:35 | 5 | 10 | 200 | 0.00 | 0.79 | 11.51 | 0.607 | 2.68 | 4.6 | 15.9 | -94.1 | -- | -- |
| 16:40 | 5 | 15 | 200 | 0.00 | 1.06 | 11.31 | 0.476 | 2.34 | 5.68 | 15.7 | -84.6 | -- | -- |
| 16:45 | 5 | 20 | 200 | 0.00 | 1.32 | 11.18 | 0.416 | 2.11 | 5.89 | 15.8 | -79.8 | -- | -- |
| 16:50 | 5 | 25 | 200 | 0.00 | 1.59 | 11.11 | 0.39 | 1.79 | 6 | 15.8 | -76.7 | -- | -- |
| 16:55 | 5 | 30 | 200 | 0.00 | 1.85 | 11.09 | 0.374 | 1.7 | 6.1 | 15.7 | -72 | -- | -- |
| 17:00 | 5 | 35 | 200 | 0.00 | 2.11 | 11.06 | 0.371 | 1.63 | 6.13 | 15.7 | -70.4 | -- | -- |
| 17:05 | 5 | 40 | 200 | 0.00 | 2.38 | 10.99 | 0.367 | 1.43 | 6.17 | 15.7 | -63.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-R7 | | | **Date** | 08/22/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | It is Clear. The wind is blowing undefined at 0.0 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 15:20 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:05 | **Volumes Purged** | | **Sample ID** | VRTB-D-R7_08222022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:00 | **Gallons Purged** | 2.38 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:25 | 0 | 0 | 200 | 0.00 | 0.26 | 7.36 | 1.462 | 3.06 | 2.39 | 17.7 | -102.4 | -- | -- |
| 15:30 | 5 | 5 | 200 | 0.00 | 0.53 | 6.93 | 1.088 | 2.91 | 0.32 | 17 | -96.9 | -- | -- |
| 15:35 | 5 | 10 | 200 | 0.00 | 0.79 | 6.94 | 1.015 | 2.37 | 0.13 | 17 | -98.2 | -- | -- |
| 15:40 | 5 | 15 | 200 | 0.00 | 1.06 | 6.99 | 0.835 | 2.11 | 0.09 | 16.6 | -100.1 | -- | -- |
| 15:45 | 5 | 20 | 200 | 0.00 | 1.32 | 7 | 0.82 | 2.01 | 0.09 | 16.9 | -100.2 | -- | -- |
| 15:50 | 5 | 25 | 200 | 0.00 | 1.59 | 7.04 | 0.717 | 1.93 | 0.09 | 16.6 | -97.5 | -- | -- |
| 15:55 | 5 | 30 | 200 | 0.00 | 1.85 | 7.06 | 0.702 | 1.83 | 0.09 | 16.8 | -96.7 | -- | -- |
| 16:00 | 5 | 35 | 200 | 0.00 | 2.11 | 7.08 | 0.696 | 1.71 | 0.09 | 16.8 | -96 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-S2 | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 70 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 09:20 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:00 | **Volumes Purged** | | **Sample ID** | VRTB-D-S2_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:50 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | Dup-02_08242022 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:25 | 0 | 0 | 200 | 0.00 | 0.26 | 6.97 | 1.251 | 3.49 | 3.26 | 14.8 | -101.6 | -- | -- |
| 09:30 | 5 | 5 | 200 | 0.00 | 0.53 | 6.79 | 1.316 | 3.01 | 0.21 | 14.2 | -103.9 | -- | -- |
| 09:35 | 5 | 10 | 200 | 0.00 | 0.79 | 6.83 | 1.191 | 2.58 | 0.11 | 14.2 | -107.9 | -- | -- |
| 09:40 | 5 | 15 | 200 | 0.00 | 1.06 | 6.83 | 1.156 | 2.36 | 0.09 | 14.2 | -108.8 | -- | -- |
| 09:45 | 5 | 20 | 200 | 0.00 | 1.32 | 6.84 | 1.135 | 2.11 | 0.09 | 14.3 | -112.1 | -- | -- |
| 09:50 | 5 | 25 | 200 | 0.00 | 1.59 | 6.85 | 1.128 | 1.94 | 0.09 | 14.3 | -112.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-Y3 | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 75 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 10:00 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:50 | **Volumes Purged** | | **Sample ID** | VRTB-D-Y3_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:45 | **Gallons Purged** | 2.64 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:05 | 0 | 0 | 200 | 0.00 | 0.26 | 7.18 | 0.921 | 3.34 | 0.17 | 14.8 | -93 | -- | -- |
| 10:10 | 5 | 5 | 200 | 0.00 | 0.53 | 7.3 | 0.931 | 3.22 | 0.08 | 14.4 | -116.9 | -- | -- |
| 10:15 | 5 | 10 | 200 | 0.00 | 0.79 | 7.31 | 0.845 | 2.98 | 0.07 | 14.3 | -119.9 | -- | -- |
| 10:20 | 5 | 15 | 200 | 0.00 | 1.06 | 7.29 | 0.719 | 2.56 | 0.07 | 14.2 | -116.7 | -- | -- |
| 10:25 | 5 | 20 | 200 | 0.00 | 1.32 | 7.29 | 0.657 | 2.43 | 0.07 | 14.3 | -112.8 | -- | -- |
| 10:30 | 5 | 25 | 200 | 0.00 | 1.59 | 7.29 | 0.611 | 2.22 | 0.07 | 14 | -109.6 | -- | -- |
| 10:35 | 5 | 30 | 200 | 0.00 | 1.85 | 7.31 | 0.581 | 2.09 | 0.07 | 14.1 | -108.6 | -- | -- |
| 10:40 | 5 | 35 | 200 | 0.00 | 2.11 | 7.33 | 0.577 | 1.78 | 0.07 | 14.2 | -107.4 | -- | -- |
| 10:45 | 5 | 40 | 200 | 0.00 | 2.38 | 7.33 | 0.564 | 1.43 | 0.07 | 14 | -105.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-B1 | | | **Date** | 08/23/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Sunny, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 12:00 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:45 | **Volumes Purged** | | **Sample ID** | VRTB-L-B1_08232022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:40 | **Gallons Purged** | 2.38 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:05 | 0 | 0 | 200 | 0.00 | 0.26 | 7.34 | 0.98 | 5.11 | 0.16 | 14.7 | -151.9 | -- | -- |
| 12:10 | 5 | 5 | 200 | 0.00 | 0.53 | 8.29 | 0.858 | 3.59 | 0.1 | 14.3 | -253.3 | -- | -- |
| 12:15 | 5 | 10 | 200 | 0.00 | 0.79 | 8.63 | 0.829 | 3.02 | 0.08 | 14.4 | -300.1 | -- | -- |
| 12:20 | 5 | 15 | 200 | 0.00 | 1.06 | 8.89 | 0.764 | 2.67 | 0.08 | 14.4 | -339.8 | -- | -- |
| 12:25 | 5 | 20 | 200 | 0.00 | 1.32 | 8.9 | 0.762 | 2.67 | 0.07 | 14.3 | -340.5 | -- | -- |
| 12:30 | 5 | 25 | 200 | 0.00 | 1.59 | 8.95 | 0.722 | 2.41 | 0.07 | 14.2 | -348.2 | -- | -- |
| 12:35 | 5 | 30 | 200 | 0.00 | 1.85 | 8.95 | 0.711 | 2.23 | 0.07 | 14.3 | -349.5 | -- | -- |
| 12:40 | 5 | 35 | 200 | 0.00 | 2.11 | 8.96 | 0.705 | 1.94 | 0.07 | 14.3 | -351.3 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-BB8 | | | **Date** | 08/23/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Sunny, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 18:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:45 | **Volumes Purged** | | **Sample ID** | VRTB-L-BB8_08232022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:40 | **Gallons Purged** | 1.59 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:20 | 0 | 0 | 200 | 0.00 | 0.26 | 7.51 | 0.415 | 2.82 | 0.08 | 14.7 | -121.6 | -- | -- |
| 18:25 | 5 | 5 | 200 | 0.00 | 0.53 | 7.51 | 0.403 | 2.46 | 0.07 | 14.3 | -126.2 | -- | -- |
| 18:30 | 5 | 10 | 200 | 0.00 | 0.79 | 7.51 | 0.399 | 2.2 | 0.06 | 14.4 | -128.5 | -- | -- |
| 18:35 | 5 | 15 | 200 | 0.00 | 1.06 | 7.51 | 0.397 | 1.89 | 0.06 | 14.4 | -129.7 | -- | -- |
| 18:40 | 5 | 20 | 200 | 0.00 | 1.32 | 7.51 | 0.395 | 1.75 | 0.06 | 14.4 | -130.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-G4 | | | **Date** | 08/23/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Sunny, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 14:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:15 | **Volumes Purged** | | **Sample ID** | VRTB-L-G4_08232022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:10 | **Gallons Purged** | 2.11 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:40 | 0 | 0 | 200 | 0.00 | 0.26 | 6.96 | 0.357 | 11.22 | 2.12 | 15.1 | -35.3 | -- | -- |
| 14:45 | 5 | 5 | 200 | 0.00 | 0.53 | 7.46 | 0.318 | 7.08 | 0.74 | 14.6 | -93.1 | -- | -- |
| 14:50 | 5 | 10 | 200 | 0.00 | 0.79 | 7.56 | 0.293 | 3.57 | 1.05 | 14.9 | -99.8 | -- | -- |
| 14:55 | 5 | 15 | 200 | 0.00 | 1.06 | 7.57 | 0.29 | 3.22 | 1.2 | 15 | -98.4 | -- | -- |
| 15:00 | 5 | 20 | 200 | 0.00 | 1.32 | 7.57 | 0.283 | 3.01 | 1.35 | 14.7 | -96.4 | -- | -- |
| 15:05 | 5 | 25 | 200 | 0.00 | 1.59 | 7.58 | 0.28 | 2.19 | 1.48 | 14.5 | -94.4 | -- | -- |
| 15:10 | 5 | 30 | 200 | 0.00 | 1.85 | 7.58 | 0.277 | 2.03 | 1.49 | 14.5 | -91.6 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-M5 | | | **Date** | 08/23/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Sunny, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 15:50 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:25 | **Volumes Purged** | | **Sample ID** | VRTB-L-M5_08232022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:20 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:55 | 0 | 0 | 200 | 0.00 | 0.26 | 7.25 | 0.437 | 9.46 | 0.33 | 15.2 | -112.1 | -- | -- |
| 16:00 | 5 | 5 | 200 | 0.00 | 0.53 | 7.56 | 0.404 | 6.44 | 0.21 | 14.8 | -155.7 | -- | -- |
| 16:05 | 5 | 10 | 200 | 0.00 | 0.79 | 7.56 | 0.397 | 2.47 | 0.16 | 14.6 | -156.9 | -- | -- |
| 16:10 | 5 | 15 | 200 | 0.00 | 1.06 | 7.56 | 0.397 | 2.22 | 0.18 | 14.5 | -157.4 | -- | -- |
| 16:15 | 5 | 20 | 200 | 0.00 | 1.32 | 7.56 | 0.395 | 1.89 | 0.19 | 14.3 | -157.8 | -- | -- |
| 16:20 | 5 | 25 | 200 | 0.00 | 1.59 | 7.56 | 0.39 | 1.73 | 0.19 | 14.5 | -158 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-O6 | | | **Date** | 08/23/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Sunny, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 16:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:15 | **Volumes Purged** | | **Sample ID** | VRTB-L-O6_08232022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:10 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:45 | 0 | 0 | 200 | 0.00 | 0.53 | 7.42 | 0.347 | 6.35 | 0.07 | 14.8 | -130.9 | -- | -- |
| 16:50 | 5 | 5 | 200 | 0.00 | 0.79 | 7.44 | 0.339 | 4.38 | 0.06 | 14.8 | -132.9 | -- | -- |
| 16:55 | 5 | 10 | 200 | 0.00 | 1.06 | 7.46 | 0.327 | 4.13 | 0.06 | 14.7 | -135.2 | -- | -- |
| 17:00 | 5 | 15 | 200 | 0.00 | 1.32 | 7.47 | 0.316 | 3.45 | 0.06 | 14.5 | -136.9 | -- | -- |
| 17:05 | 5 | 20 | 200 | 0.00 | 1.59 | 7.48 | 0.313 | 3.11 | 0.06 | 14.4 | -138.7 | -- | -- |
| 17:10 | 5 | 25 | 200 | 0.00 | 1.85 | 7.49 | 0.312 | 2.88 | 0.06 | 14.3 | -139.5 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-P7 | | | **Date** | 08/23/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 80 °F, Sunny, W winds at 2 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 17:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:05 | **Volumes Purged** | | **Sample ID** | VRTB-L-P7_08232022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:00 | **Gallons Purged** | 1.59 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:40 | 0 | 0 | 200 | 0.00 | 0.26 | 6.9 | 1.908 | 12.84 | 0.27 | 14.4 | -108.8 | -- | -- |
| 17:45 | 5 | 5 | 200 | 0.00 | 0.53 | 6.97 | 1.258 | 10.45 | 0.09 | 14.2 | -120.6 | -- | -- |
| 17:50 | 5 | 10 | 200 | 0.00 | 0.79 | 7 | 1.192 | 9.72 | 0.08 | 14.4 | -125.3 | -- | -- |
| 17:55 | 5 | 15 | 200 | 0.00 | 1.06 | 7.02 | 1.176 | 9.34 | 0.08 | 14.3 | -128 | -- | -- |
| 18:00 | 5 | 20 | 200 | 0.00 | 1.32 | 7.03 | 1.171 | 9.09 | 0.08 | 14.3 | -128.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-S2 | | | **Date** | 08/23/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Sunny, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 12:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:30 | **Volumes Purged** | | **Sample ID** | VRTB-L-S2_08232022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:25 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:00 | 0 | 0 | 200 | 0.00 | 0.26 | 9.9 | 1.021 | 4.91 | 0.13 | 14.2 | -214.6 | -- | -- |
| 13:05 | 5 | 5 | 200 | 0.00 | 0.53 | 9.54 | 0.901 | 2.39 | 0.11 | 13.9 | -271 | -- | -- |
| 13:10 | 5 | 10 | 200 | 0.00 | 0.79 | 9.21 | 0.786 | 2.21 | 0.1 | 14.1 | -318.8 | -- | -- |
| 13:15 | 5 | 15 | 200 | 0.00 | 1.06 | 9.05 | 0.733 | 2.01 | 0.1 | 13.8 | -318.1 | -- | -- |
| 13:20 | 5 | 20 | 200 | 0.00 | 1.32 | 8.98 | 0.713 | 1.76 | 0.1 | 13.8 | -320.6 | -- | -- |
| 13:25 | 5 | 25 | 200 | 0.00 | 1.59 | 8.97 | 0.712 | 1.7 | 0.1 | 13.8 | -319.6 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-Y3 | | | **Date** | 08/23/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Sunny, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 13:30 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:25 | **Volumes Purged** | | **Sample ID** | VRTB-L-Y3_08232022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:20 | **Gallons Purged** | 2.91 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:10 | 0 | 0 | 200 | 0.00 | 2.11 | 7.53 | 0.309 | 3.92 | 6.68 | 14.3 | -47.1 | -- | -- |
| 14:15 | 5 | 5 | 200 | 0.00 | 2.38 | 7.54 | 0.308 | 3.64 | 6.72 | 14.4 | -43.9 | -- | -- |
| 14:20 | 5 | 10 | 200 | 0.00 | 2.64 | 7.54 | 0.307 | 3.51 | 6.69 | 14.3 | -42 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| Top Assay | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-B1 | | | **Date** | 08/22/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 78.1 degrees F and Clear. The wind is blowing N at 10.3 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 17:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:05 | **Volumes Purged** | | **Sample ID** | VRTB-S-B1_08222022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:00 | **Gallons Purged** | 2.11 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:30 | 0 | 0 | 200 | 0.00 | 0.26 | 7.26 | 0.919 | 6.72 | 0.49 | 15.7 | -96.3 | -- | -- |
| 17:35 | 5 | 5 | 200 | 0.00 | 0.53 | 7.18 | 0.935 | 5.5 | 0.41 | 15.7 | -90 | -- | -- |
| 17:40 | 5 | 10 | 200 | 0.00 | 0.79 | 7.18 | 0.884 | 5.28 | 0.39 | 15.6 | -84 | -- | -- |
| 17:45 | 5 | 15 | 200 | 0.00 | 1.06 | 7.18 | 0.844 | 4.31 | 0.37 | 15.4 | -76.4 | -- | -- |
| 17:50 | 5 | 20 | 200 | 0.00 | 1.32 | 7.2 | 0.82 | 4.12 | 0.36 | 15.4 | -74.1 | -- | -- |
| 17:55 | 5 | 25 | 200 | 0.00 | 1.59 | 7.2 | 0.815 | 3.77 | 0.35 | 15.3 | -72.9 | -- | -- |
| 18:00 | 5 | 30 | 200 | 0.00 | 1.85 | 7.2 | 0.801 | 3.35 | 0.33 | 15.2 | -66.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-G4 | | | **Date** | 08/23/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 75 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 09:30 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:20 | **Volumes Purged** | | **Sample ID** | VRTB-S-G4_08232022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:15 | **Gallons Purged** | 2.38 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:40 | 0 | 0 | 200 | 0.00 | 0.53 | 7.44 | 0.498 | 12.3 | 1.09 | 13.8 | 16.9 | -- | -- |
| 09:45 | 5 | 5 | 200 | 0.00 | 0.79 | 7.59 | 0.5 | 5.98 | 1.03 | 13.8 | 6.7 | -- | -- |
| 09:50 | 5 | 10 | 200 | 0.00 | 1.06 | 7.78 | 0.483 | 5.51 | 2.19 | 13.8 | -5.1 | -- | -- |
| 09:55 | 5 | 15 | 200 | 0.00 | 1.32 | 7.87 | 0.474 | 5.26 | 2.88 | 13.9 | -5.4 | -- | -- |
| 10:00 | 5 | 20 | 200 | 0.00 | 1.59 | 7.95 | 0.468 | 4.77 | 3.5 | 14 | 0.6 | -- | -- |
| 10:05 | 5 | 25 | 200 | 0.00 | 1.85 | 8.02 | 0.452 | 4.12 | 4.34 | 14.1 | 12.5 | -- | -- |
| 10:10 | 5 | 30 | 200 | 0.00 | 2.11 | 8.02 | 0.45 | 4.01 | 4.4 | 14 | 14.1 | -- | -- |
| 10:15 | 5 | 35 | 200 | 0.00 | 2.38 | 8.05 | 0.444 | 3.61 | 4.71 | 14 | 18.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-M5 | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 11:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:40 | **Volumes Purged** | | **Sample ID** | VRTB-S-M5_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:35 | **Gallons Purged** | 2.38 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:20 | 0 | 0 | 200 | 0.00 | 1.32 | 7.68 | 0.402 | 3.09 | 3.06 | 15.3 | 10.3 | -- | -- |
| 12:25 | 5 | 5 | 200 | 0.00 | 1.59 | 7.7 | 0.378 | 2.61 | 3.44 | 15.2 | 12 | -- | -- |
| 12:30 | 5 | 10 | 200 | 0.00 | 1.85 | 7.71 | 0.373 | 2.25 | 3.59 | 15.4 | 12.8 | -- | -- |
| 12:35 | 5 | 15 | 200 | 0.00 | 2.11 | 7.7 | 0.369 | 2.14 | 3.69 | 15.4 | 15.1 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |
| Total Organic Carbon | 250 mL Plastic | 1 | H2SO4 |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-O6 | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 12:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:00 | **Volumes Purged** | | **Sample ID** | VRTB-S-O6_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:55 | **Gallons Purged** | 3.43 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:30 | 0 | 0 | 200 | 0.00 | 1.85 | 7.76 | 0.355 | 7.48 | 3.81 | 15.4 | 9 | -- | -- |
| 13:35 | 5 | 5 | 200 | 0.00 | 2.11 | 7.78 | 0.333 | 7.78 | 4.4 | 15 | 15.3 | -- | -- |
| 13:40 | 10 | 15 | 200 | 0.00 | 2.38 | 7.8 | 0.318 | 7.8 | 5.21 | 15.8 | 21.6 | -- | -- |
| 13:45 | 5 | 15 | 200 | 0.00 | 2.64 | 7.8 | 0.315 | 5.81 | 5.25 | 16 | 22.4 | -- | -- |
| 13:50 | 5 | 20 | 200 | 0.00 | 2.91 | 7.81 | 0.306 | 5.12 | 5.39 | 15.8 | 26.3 | -- | -- |
| 13:55 | 5 | 25 | 200 | 0.00 | 3.17 | 7.81 | 0.306 | 4.9 | 5.44 | 15.7 | 27.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-P8 | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 15:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:05 | **Volumes Purged** | | **Sample ID** | VRTB-S-P8_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:00 | **Gallons Purged** | 2.64 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:20 | 0 | 0 | 200 | 0.00 | 0.26 | 11.88 | 1.178 | 7.13 | 3.32 | 15.1 | -102.2 | -- | -- |
| 15:25 | 5 | 5 | 200 | 0.00 | 0.53 | 11.83 | 1.081 | 5.01 | 3.74 | 15 | -92.4 | -- | -- |
| 15:30 | 5 | 10 | 200 | 0.00 | 0.79 | 11.8 | 1.074 | 3.28 | 4.04 | 14.9 | -86.4 | -- | -- |
| 15:35 | 5 | 15 | 200 | 0.00 | 1.06 | 11.72 | 1.037 | 2.55 | 5.27 | 15.5 | -80.2 | -- | -- |
| 15:40 | 5 | 20 | 200 | 0.00 | 1.32 | 11.63 | 0.993 | 2.37 | 5.91 | 15.5 | -72.5 | -- | -- |
| 15:45 | 5 | 25 | 200 | 0.00 | 1.59 | 11.5 | 0.94 | 2.03 | 6.24 | 15.6 | -64.9 | -- | -- |
| 15:50 | 5 | 30 | 200 | 0.00 | 1.85 | 11.33 | 0.871 | 1.9 | 6.43 | 15.9 | -55.9 | -- | -- |
| 15:55 | 5 | 35 | 200 | 0.00 | 2.11 | 11.26 | 0.857 | 1.64 | 6.4 | 16 | -52.9 | -- | -- |
| 16:00 | 5 | 40 | 200 | 0.00 | 2.38 | 11.25 | 0.853 | 1.56 | 6.42 | 16 | -51.6 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-R7 | | | **Date** | 08/24/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 80 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 14:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:55 | **Volumes Purged** | | **Sample ID** | VRTB-S-R7_08242022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:50 | **Gallons Purged** | 2.11 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:25 | 0 | 0 | 200 | 0.00 | 0.53 | 7.06 | 1.521 | 4.67 | 0.59 | 15 | 63.7 | -- | -- |
| 14:30 | 5 | 5 | 200 | 0.00 | 0.79 | 7.11 | 1.367 | 2.68 | 0.47 | 15.8 | 78.34 | -- | -- |
| 14:35 | 5 | 10 | 200 | 0.00 | 1.06 | 7.14 | 1.259 | 2.19 | 0.61 | 16 | 52 | -- | -- |
| 14:40 | 5 | 15 | 200 | 0.00 | 1.32 | 7.16 | 1.203 | 1.77 | 0.7 | 16.1 | 49.5 | -- | -- |
| 14:45 | 5 | 20 | 200 | 0.00 | 1.59 | 7.17 | 1.172 | 1.57 | 0.73 | 16 | 49 | -- | -- |
| 14:50 | 5 | 25 | 200 | 0.00 | 1.85 | 7.19 | 1.168 | 1.41 | 0.71 | 16 | 47.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |
| Total Organic Carbon | 250 mL Plastic | 1 | H2SO4 |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-S2 | | | **Date** | 08/22/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | **Weather(°F)** | 78.1 degrees F and Clear. The wind is blowing N at 10.3 mph. | | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 18:05 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:40 | **Volumes Purged** | | **Sample ID** | VRTB-S-S2_08222022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:35 | **Gallons Purged** | 1.85 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:10 | 0 | 0 | 200 | 0.00 | 0.26 | 7.31 | 0.369 | 44.64 | 5.28 | 18.3 | -3.4 | -- | -- |
| 18:15 | 5 | 5 | 200 | 0.00 | 0.53 | 7.69 | 0.614 | 21.13 | 2.17 | 15.6 | -62.5 | -- | -- |
| 18:20 | 5 | 10 | 200 | 0.00 | 0.79 | 7.66 | 0.625 | 6.88 | 1.6 | 15.4 | -56.9 | -- | -- |
| 18:25 | 5 | 15 | 200 | 0.00 | 1.06 | 7.6 | 0.605 | 3.91 | 1.31 | 15.4 | -56.2 | -- | -- |
| 18:30 | 5 | 20 | 200 | 0.00 | 1.32 | 7.59 | 0.591 | 3.74 | 1.28 | 15.2 | -53.6 | -- | -- |
| 18:35 | 5 | 25 | 200 | 0.00 | 1.59 | 7.57 | 0.588 | 3.55 | 1.25 | 15 | -53.6 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-Y3 | | | **Date** | 08/23/2022 |
| **Project Name/Location** | ESTCP GAAF / Grayling, MI | | **Weather(°F)** | 70 °F, Overcast, W winds at 2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | NA |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0 | **Gallons in Well** | |
| **Purge Start** | 08:30 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:25 | **Volumes Purged** | | **Sample ID** | VRTB-S-Y3_08232022 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:20 | **Gallons Purged** | 2.91 | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallons Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:35 | 0 | 0 | 200 | 0.00 | 0.26 | 7.41 | 1.084 | 71.54 | 0.11 | 14.3 | -97 | -- | -- |
| 08:40 | 5 | 5 | 200 | 0.00 | 0.53 | 7.44 | 1.071 | 43.12 | 0.14 | 14.1 | -101.6 | -- | -- |
| 08:45 | 5 | 10 | 200 | 0.00 | 0.79 | 7.44 | 0.946 | 32.21 | 0.11 | 14 | -103.8 | -- | -- |
| 08:50 | 5 | 15 | 200 | 0.00 | 1.06 | 7.44 | 0.93 | 30.12 | 0.15 | 14 | -103.5 | -- | -- |
| 08:55 | 5 | 20 | 200 | 0.00 | 1.32 | 7.43 | 0.894 | 28.94 | 0.24 | 14 | -102.5 | -- | -- |
| 09:00 | 5 | 25 | 200 | 0.00 | 1.59 | 7.4 | 0.817 | 26.91 | 0.28 | 14 | -98.3 | -- | -- |
| 09:05 | 5 | 30 | 200 | 0.00 | 1.85 | 7.4 | 0.81 | 26.42 | 0.3 | 14 | -98 | -- | -- |
| 09:10 | 5 | 35 | 200 | 0.00 | 2.11 | 7.4 | 0.77 | 24.61 | 0.33 | 14.1 | -94.7 | -- | -- |
| 09:15 | 5 | 40 | 200 | 0.00 | 2.38 | 7.4 | 0.757 | 23.29 | 0.34 | 14.1 | -92.4 | -- | -- |
| 09:20 | 5 | 45 | 200 | 0.00 | 2.64 | 7.4 | 0.749 | 22.96 | 0.36 | 14 | -91.8 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 250mL HDPE Plastic | 2 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Logs

# Performance Monitoring Event #5

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_2 | | | **Date** | 10/23/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 31°F, sunny | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 0.5 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.34 | **Total Depth (ft-bmp)** | 17 | **Water Column (ft)** | 1.66 | **Gallons in Well** | 0.02 |
| **Purge Start** | 11:28 | **Pump Intake (ft-bmp)** | 16 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:09 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_2_10232023 | **Sampled by** | Madison Olender |
| **Sample Time** | 12:03 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:29 | 0 | 0 | 200 | 15.34 | 0.00 | 6.47 | 0.38 | 40.5 | 3.31 | 11.7 | 169 | Clear | None |
| 11:32 | 3 | 3 | 200 | 15.34 | 0.00 | 7.28 | 0.343 | 4.3 | 3.22 | 11.6 | 137.8 | Clear | None |
| 11:35 | 3 | 6 | 200 | 15.34 | 0.00 | 7.48 | 0.325 | 0.84 | 3.14 | 11.7 | 119.1 | Clear | None |
| 11:38 | 3 | 9 | 200 | 15.34 | 0.00 | 7.55 | 0.319 | 1.17 | 2.95 | 11.7 | 108.1 | Clear | None |
| 11:43 | 5 | 14 | 200 | 15.34 | 0.00 | 7.6 | 0.319 | 0.02 | 3 | 11.7 | 98.6 | Clear | None |
| 11:48 | 5 | 19 | 200 | 15.34 | 0.00 | 7.61 | 0.317 | 0.02 | 2.88 | 11.7 | 91.9 | Clear | None |
| 11:53 | 5 | 24 | 200 | 15.34 | 0.00 | 7.62 | 0.315 | 0.02 | 3.1 | 11.7 | 87.1 | Clear | None |
| 11:56 | 3 | 27 | 200 | 15.34 | 0.00 | 7.62 | 0.314 | 0.02 | 3.21 | 11.7 | 84.4 | Clear | None |
| 11:59 | 3 | 30 | 200 | 15.34 | 0.00 | 7.63 | 0.314 | 0.02 | 3.18 | 11.7 | 81.1 | Clear | None |
| 12:02 | 3 | 33 | 200 | 15.34 | 0.00 | 7.63 | 0.314 | 0.02 | 3.07 | 11.7 | 78.6 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See map
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_3 | | | **Date** | 10/23/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | **Weather(°F)** | | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 0.5 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.50 | **Total Depth (ft-bmp)** | 19.5 | **Water Column (ft)** | 4.00 | **Gallons in Well** | 0.04 |
| **Purge Start** | 12:53 | **Pump Intake (ft-bmp)** | 17.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:40 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-1_3_10232023 | **Sampled by** | Madison Olender |
| **Sample Time** | 13:30 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:54 | 0 | 0 | 200 | 15.50 | 0.00 | 7.59 | 0.285 | 12.6 | 8.23 | 11.5 | 102.7 | Clear | None |
| 12:59 | 5 | 5 | 200 | 15.50 | 0.00 | 7.72 | 0.334 | 7.8 | 9.17 | 11.5 | 95.3 | Clear | None |
| 13:04 | 5 | 10 | 200 | 15.50 | 0.00 | 7.7 | 0.292 | 3.11 | 10.11 | 11.5 | 93.2 | Clear | None |
| 13:09 | 5 | 15 | 200 | 15.50 | 0.00 | 7.7 | 0.313 | 0.2 | 11.04 | 11.5 | 90.9 | Clear | None |
| 13:14 | 5 | 20 | 200 | 15.50 | 0.00 | 7.7 | 0.311 | 0.02 | 11.02 | 11.4 | 88.8 | Clear | None |
| 13:19 | 5 | 25 | 200 | 15.50 | 0.00 | 7.7 | 0.311 | 0.02 | 10.87 | 11.4 | 86 | Clear | None |
| 13:24 | 5 | 30 | 200 | 15.50 | 0.00 | 7.72 | 0.312 | 0.02 | 10.48 | 11.4 | 83.8 | Clear | None |
| 13:29 | 5 | 35 | 200 | 15.50 | 0.00 | 7.71 | 0.312 | 0.02 | 10.78 | 11.4 | 82.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:** Could not fit meter down to measure depth of water. I used to bring to try to verify and it looked like there was approximately 4 feet of water in this well

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_4 | | | **Date** | 10/23/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | **Weather(°F)** | | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 0.5 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.34 | **Total Depth (ft-bmp)** | 23 | **Water Column (ft)** | 7.66 | **Gallons in Well** | 0.08 |
| **Purge Start** | 13:50 | **Pump Intake (ft-bmp)** | 20.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:45 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_4_10232023 | **Sampled by** | Madison Olender |
| **Sample Time** | 14:35 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:51 | 0 | 0 | 200 | 15.34 | 0.00 | 7.43 | 0.276 | 6.25 | 6.7 | 11 | 94.4 | Clear | |
| 13:56 | 5 | 5 | 200 | 15.34 | 0.00 | 7.77 | 0.282 | 0.02 | 8.57 | 11 | 86.7 | Clear | |
| 14:01 | 5 | 10 | 200 | 15.34 | 0.00 | 7.78 | 0.278 | 0.02 | 8.58 | 11 | 85.9 | Clear | |
| 14:06 | 5 | 15 | 200 | 15.34 | 0.00 | 7.72 | 0.278 | 0.02 | 8.34 | 11 | 85.9 | Clear | |
| 14:11 | 5 | 20 | 200 | 15.34 | 0.00 | 7.76 | 0.277 | 0.02 | 8.8 | 11 | 85.4 | Clear | |
| 14:16 | 5 | 25 | 200 | 15.34 | 0.00 | 7.75 | 0.285 | 0.02 | 8.84 | 11 | 85.8 | Clear | |
| 14:21 | 5 | 30 | 200 | 15.34 | 0.00 | 7.75 | 0.297 | 0.02 | 9.93 | 11 | 86.1 | Clear | |
| 14:26 | 5 | 35 | 200 | 15.34 | 0.00 | 7.75 | 0.298 | 0.02 | 9.99 | 11 | 86.5 | Clear | |
| 14:31 | 5 | 40 | 200 | 15.34 | 0.00 | 7.75 | 0.298 | 0.02 | 9.98 | 11 | 87 | Clear | |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_5 | | | **Date** | 10/23/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | **Weather(°F)** | | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 0.5 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.32 | **Total Depth (ft-bmp)** | 26.5 | **Water Column (ft)** | 11.18 | **Gallons in Well** | 0.11 |
| **Purge Start** | 14:59 | **Pump Intake (ft-bmp)** | 24 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:15 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_5_10232023 | **Sampled by** | Madison Olender |
| **Sample Time** | 15:45 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:01 | 0 | 0 | 200 | 15.32 | 0.00 | 7.49 | 0.283 | 48.4 | 7.86 | 10.8 | 92.9 | Clear | None |
| 15:06 | 5 | 5 | 200 | 15.32 | 0.00 | 7.82 | 0.306 | 20.6 | 7.61 | 10.8 | 88.1 | Clear | None |
| 15:11 | 5 | 10 | 200 | 15.32 | 0.00 | 7.78 | 0.303 | 3.86 | 7.46 | 10.8 | 87.9 | Clear | None |
| 15:16 | 5 | 15 | 200 | 15.32 | 0.00 | 7.78 | 0.301 | 0.02 | 7.5 | 10.8 | 86.3 | Clear | None |
| 15:21 | 5 | 20 | 200 | 15.32 | 0.00 | 7.8 | 0.317 | 0.02 | 7.55 | 10.8 | 82.3 | Clear | None |
| 15:26 | 5 | 25 | 200 | 15.32 | 0.00 | 7.77 | 0.302 | 0.02 | 7.39 | 10.8 | 77.5 | Clear | None |
| 15:31 | 5 | 30 | 200 | 15.32 | 0.00 | 7.77 | 0.282 | 0.02 | 7.27 | 10.8 | 72.5 | Clear | None |
| 15:36 | 5 | 35 | 200 | 15.32 | 0.00 | 7.78 | 0.28 | 0.02 | 7.33 | 10.8 | 68.2 | Clear | None |
| 15:41 | 5 | 40 | 200 | 15.32 | 0.00 | 7.77 | 0.278 | 0.02 | 7.3 | 10.8 | 66.8 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 9 | None |

**Comments:** MSMSD collected

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_6 | | | **Date** | 10/25/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 59.0 degrees F and Cloudy. The wind is blowing W/SW at 5.8 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 0.5 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.33 | **Total Depth (ft-bmp)** | 30.5 | **Water Column (ft)** | 15.17 | **Gallons in Well** | 0.15 |
| **Purge Start** | 16:23 | **Pump Intake (ft-bmp)** | 28 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:36 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_6_10252023 | **Sampled by** | Madison Olender |
| **Sample Time** | 17:26 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:24 | 0 | 0 | 200 | 15.33 | 0.00 | 8.38 | 0.235 | 10.4 | 6.25 | 11.7 | 16.7 | Clear | None |
| 16:29 | 5 | 5 | 200 | 15.33 | 0.00 | 8 | 0.233 | 4.1 | 8.04 | 11.5 | 10 | Clear | None |
| 16:34 | 5 | 10 | 200 | 15.33 | 0.00 | 7.89 | 0.219 | 2.27 | 8.12 | 11.1 | 14.4 | Clear | None |
| 16:39 | 5 | 15 | 200 | 15.33 | 0.00 | 7.89 | 0.239 | 0.02 | 8.06 | 11.4 | 13.9 | Clear | None |
| 16:44 | 5 | 20 | 200 | 15.33 | 0.00 | 7.91 | 0.239 | 0.02 | 8.11 | 11.3 | 13.1 | Clear | None |
| 16:49 | 5 | 25 | 200 | 15.33 | 0.00 | 7.92 | 0.242 | 0.02 | 8.38 | 11.2 | 13.9 | Clear | None |
| 16:54 | 5 | 30 | 200 | 15.33 | 0.00 | 7.9 | 0.238 | 0.02 | 8.17 | 11.3 | 14.4 | Clear | None |
| 16:59 | 5 | 35 | 200 | 15.33 | 0.00 | 7.96 | 0.219 | 0.02 | 8.13 | 11.3 | 11.4 | Clear | None |
| 17:04 | 5 | 40 | 200 | 15.33 | 0.00 | 7.94 | 0.242 | 0.02 | 8.11 | 11.1 | 13.6 | Clear | None |
| 17:09 | 5 | 45 | 200 | 15.33 | 0.00 | 7.93 | 0.226 | 0.02 | 8.21 | 11.2 | 13.5 | Clear | None |
| 17:14 | 5 | 50 | 200 | 15.33 | 0.00 | 7.96 | 0.229 | 0.02 | 8.09 | 11.3 | 12.2 | Clear | None |
| 17:19 | 5 | 55 | 200 | 15.33 | 0.00 | 7.94 | 0.225 | 0.02 | 8.21 | 11.2 | 13.2 | Clear | None |
| 17:24 | 5 | 60 | 200 | 15.33 | 0.00 | 7.94 | 0.237 | 0.02 | 8.13 | 11.2 | 13.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-B1 | | | **Date** | 10/26/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 56.5 degrees F and Light Rain and Fog/Mist. The wind is blowing SE at 5.8 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 08:16 | **Pump Intake (ft-bmp)** | 385 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:30 | **Volumes Purged** | | **Sample ID** | VRTB-D-B1_10262023 | **Sampled by** | Madison Olender |
| **Sample Time** | 09:20 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:19 | 0 | 0 | 200 | | 0.00 | 9.09 | 0.473 | 0.02 | 0.77 | 12.7 | -32.6 | Clear | None |
| 08:24 | 5 | 5 | 200 | | 0.00 | 11.77 | 2.22 | 0.02 | 0.14 | 12.3 | -79.6 | Clear | None |
| 08:29 | 5 | 10 | 200 | | 0.00 | 11.83 | 1.69 | 0.02 | 0.43 | 12.2 | -101.4 | Clear | None |
| 08:34 | 5 | 15 | 200 | | 0.00 | 11.75 | 1.11 | 0.02 | 0.9 | 12.2 | -106.5 | Clear | None |
| 08:39 | 5 | 20 | 200 | | 0.00 | 11.62 | 0.85 | 0.02 | 1.06 | 12.1 | -95.1 | Clear | None |
| 08:44 | 5 | 25 | 200 | | 0.00 | 11.49 | 0.661 | 0.02 | 1.2 | 12.1 | -81.2 | Clear | None |
| 08:49 | 5 | 30 | 200 | | 0.00 | 11.35 | 0.489 | 0.02 | 1.45 | 12.1 | -69.9 | Clear | None |
| 08:54 | 5 | 35 | 200 | | 0.00 | 11.2 | 0.393 | 0.02 | 1.82 | 12 | -60.9 | Clear | None |
| 08:59 | 5 | 40 | 200 | | 0.00 | 11.01 | 0.412 | 0.02 | 2.13 | 12.1 | -52.9 | Clear | None |
| 09:04 | 5 | 45 | 200 | | 0.00 | 10.99 | 0.389 | 0.02 | 2.22 | 12.2 | -51.1 | Clear | None |
| 09:09 | 5 | 50 | 200 | | 0.00 | 10.86 | 0.326 | 0.02 | 2.27 | 12.3 | -48 | Clear | None |
| 09:14 | 5 | 55 | 200 | | 0.00 | 10.74 | 0.309 | 0.02 | 2.51 | 12.2 | -44.4 | Clear | None |
| 09:19 | 5 | 60 | 200 | | 0.00 | 10.62 | 0.349 | 0.02 | 2.94 | 12.1 | -40.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-G4 | | | **Date** | 10/26/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 59.0 degrees F and Light Rain. The wind is blowing S at 8.1 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 11:14 | **Pump Intake (ft-bmp)** | 265 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:58 | **Volumes Purged** | | **Sample ID** | VRTB-D-G4_10262023 | **Sampled by** | Madison Olender |
| **Sample Time** | 11:48 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:16 | 0 | 0 | 200 | | 0.00 | 7.88 | 0.296 | 0.02 | 2.05 | 13 | -29.1 | Clear | None |
| 11:21 | 5 | 5 | 200 | | 0.00 | 7.38 | 0.257 | 0.02 | 13.9 | 12.2 | -13.5 | Clear | None |
| 11:26 | 5 | 10 | 200 | | 0.00 | 7.44 | 0.247 | 0.02 | 1.56 | 12.2 | -48.7 | Clear | None |
| 11:31 | 5 | 15 | 200 | | 0.00 | 7.53 | 0.233 | 0.02 | 1.68 | 12.4 | -52 | Clear | None |
| 11:36 | 5 | 20 | 200 | | 0.00 | 7.62 | 0.227 | 0.02 | 2.1 | 12.4 | -52 | Clear | None |
| 11:41 | 5 | 25 | 200 | | 0.00 | 7.62 | 0.225 | 0.02 | 2.12 | 12.4 | -48.9 | Clear | None |
| 11:46 | 5 | 30 | 200 | | 0.00 | 7.62 | 0.222 | 0.02 | 2.15 | 12.4 | -46.1 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-M5 | | | **Date** | 10/25/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 59.0 degrees F and Cloudy. The wind is blowing SW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 11:10 | **Pump Intake (ft-bmp)** | 225 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:04 | **Volumes Purged** | | **Sample ID** | VRTB-D-M5_10252023 | **Sampled by** | Madison Olender |
| **Sample Time** | 11:54 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:12 | 0 | 0 | 200 | | 0.00 | 7.67 | 0.47 | 0.62 | 1.77 | 12.8 | 43.5 | Clear | None |
| 11:17 | 5 | 5 | 200 | | 0.00 | 7.39 | 0.477 | 0.02 | 2.73 | 12.4 | 13.7 | Clear | None |
| 11:22 | 5 | 10 | 200 | | 0.00 | 7.62 | 0.369 | 0.02 | 0.87 | 12.3 | -13.2 | Clear | None |
| 11:27 | 5 | 15 | 200 | | 0.00 | 7.81 | 0.335 | 0.02 | 1.29 | 12.3 | -31.1 | Clear | None |
| 11:32 | 5 | 20 | 200 | | 0.00 | 7.88 | 0.321 | 0.02 | 2.07 | 12.1 | -37.9 | Clear | None |
| 11:37 | 5 | 25 | 200 | | 0.00 | 7.94 | 0.3 | 0.02 | 2.53 | 12.2 | -43.3 | Clear | None |
| 11:42 | 5 | 30 | 200 | | 0.00 | 7.98 | 0.272 | 0.02 | 2.8 | 12.2 | -43.8 | Clear | None |
| 11:47 | 5 | 35 | 200 | | 0.00 | 8 | 0.265 | 0.02 | 3.06 | 12.2 | -40.9 | Clear | None |
| 11:50 | 3 | 38 | 200 | | 0.00 | 7.99 | 0.263 | 0.02 | 3.03 | 12.2 | -39.1 | Clear | None |
| 11:53 | 3 | 41 | 200 | | 0.00 | 8 | 0.262 | 0.02 | 3.14 | 12.2 | -38.8 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-O6 | | | **Date** | 10/25/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 61.3 degrees F and Cloudy. The wind is blowing W/SW at 4.6 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 12:44 | **Pump Intake (ft-bmp)** | 185 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:42 | **Volumes Purged** | | **Sample ID** | VRTB-D-O6_10252023 | **Sampled by** | Madison Olender |
| **Sample Time** | 13:32 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:47 | 0 | 0 | 200 | | 0.00 | 7.55 | 0.522 | 0.02 | 0.88 | 13.1 | 37.8 | Clear | None |
| 12:52 | 5 | 5 | 200 | | 0.00 | 7.37 | 0.552 | 0.02 | 1.3 | 12.6 | -15.8 | Clear | None |
| 12:57 | 5 | 10 | 200 | | 0.00 | 7.31 | 0.401 | 0.02 | 0.56 | 12.5 | -46.5 | Clear | None |
| 13:02 | 5 | 15 | 200 | | 0.00 | 7.33 | 0.341 | 0.02 | 1.21 | 12.4 | -54.7 | Clear | None |
| 13:07 | 5 | 20 | 200 | | 0.00 | 7.39 | 0.299 | 0.02 | 2.04 | 12.3 | -58.4 | Clear | None |
| 13:12 | 5 | 25 | 200 | | 0.00 | 7.42 | 0.298 | 0.02 | 2.56 | 12.2 | -58.3 | Clear | None |
| 13:17 | 5 | 30 | 200 | | 0.00 | 7.48 | 0.281 | 0.02 | 2.95 | 12.2 | -58.6 | Clear | None |
| 13:22 | 5 | 35 | 200 | | 0.00 | 7.51 | 0.286 | 0.02 | 3.17 | 12.2 | -57.3 | Clear | None |
| 13:25 | 3 | 38 | 200 | | 0.00 | 7.53 | 0.282 | 0.02 | 3.28 | 12.2 | -56.5 | Clear | None |
| 13:28 | 3 | 41 | 200 | | 0.00 | 7.54 | 0.283 | 0.02 | 3.3 | 12.2 | -57 | Clear | None |
| 13:31 | 3 | 44 | 200 | | 0.00 | 7.55 | 0.281 | 0.02 | 3.29 | 12.2 | -56.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-P8 | | | **Date** | 10/25/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 14:36 | **Pump Intake (ft-bmp)** | 105 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:49 | **Volumes Purged** | | **Sample ID** | VRTB-D-P8_10252023 | **Sampled by** | Madison Olender |
| **Sample Time** | 15:39 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:38 | 0 | 0 | 200 | | 0.00 | 8.52 | 0.248 | 0.02 | 0.97 | 12.7 | -25.8 | Clear | None |
| 14:43 | 5 | 5 | 200 | | 0.00 | 11.71 | 1.67 | 0.02 | 0.65 | 12.4 | -123.8 | Clear | None |
| 14:48 | 5 | 10 | 200 | | 0.00 | 11.81 | 1.39 | 0.02 | 0.54 | 12.5 | -146.4 | Clear | None |
| 14:53 | 5 | 15 | 200 | | 0.00 | 11.56 | 0.71 | 0.02 | 0.67 | 12.4 | -124.1 | Clear | None |
| 14:58 | 5 | 20 | 200 | | 0.00 | 11.34 | 0.496 | 0.02 | 0.91 | 12.3 | -98.2 | Clear | None |
| 15:03 | 5 | 25 | 200 | | 0.00 | 11.13 | 0.4 | 0.02 | 1.17 | 12.3 | -82 | Clear | None |
| 15:08 | 5 | 30 | 200 | | 0.00 | 10.96 | 0.35 | 0.02 | 1.36 | 12.3 | -70.4 | Clear | None |
| 15:13 | 5 | 35 | 200 | | 0.00 | 10.82 | 0.322 | 0.02 | 1.61 | 12.3 | -62.9 | Clear | None |
| 15:18 | 5 | 40 | 200 | | 0.00 | 10.69 | 0.3 | 0.02 | 1.78 | 12.3 | -58 | Clear | None |
| 15:23 | 5 | 45 | 200 | | 0.00 | 10.6 | 0.291 | 0.02 | 1.93 | 12.3 | -54.4 | Clear | None |
| 15:28 | 5 | 50 | 200 | | 0.00 | 10.51 | 0.284 | 0.02 | 2.19 | 12.2 | -49.9 | Clear | None |
| 15:33 | 5 | 55 | 200 | | 0.00 | 10.49 | 0.281 | 0.02 | 2.47 | 12.2 | -48.3 | Clear | None |
| 15:38 | 5 | 60 | 200 | | 0.00 | 10.4 | 0.272 | 0.02 | 2.62 | 12.3 | -46 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-R7 | | | **Date** | 10/25/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 61.3 degrees F and Cloudy. The wind is blowing W/SW at 4.6 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 13:50 | **Pump Intake (ft-bmp)** | 145 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:32 | **Volumes Purged** | | **Sample ID** | VTRB-D-R7_10252023 | **Sampled by** | Madison Olender |
| **Sample Time** | 14:22 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:51 | 0 | 0 | 200 | | 0.00 | 7.55 | 0.608 | 0.02 | 5.39 | 12.9 | -40.3 | Clear | None |
| 13:56 | 5 | 5 | 200 | | 0.00 | 7.42 | 0.635 | 0.02 | 2.03 | 12.5 | -88.2 | Clear | None |
| 14:01 | 5 | 10 | 200 | | 0.00 | 7.31 | 0.436 | 0.02 | 1.46 | 12.5 | -84.8 | Clear | None |
| 14:06 | 5 | 15 | 200 | | 0.00 | 7.31 | 0.39 | 0.02 | 0.03 | 12.5 | -86.4 | Clear | None |
| 14:11 | 5 | 20 | 200 | | 0.00 | 7.35 | 0.349 | 0.02 | 0.13 | 12.4 | -88 | Clear | None |
| 14:16 | 5 | 25 | 200 | | 0.00 | 7.36 | 0.342 | 0.02 | 0.13 | 12.4 | -89.1 | Clear | None |
| 14:21 | 5 | 30 | 200 | | 0.00 | 7.39 | 0.34 | 0.02 | 0.12 | 12.4 | -91.5 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-S2 | | | **Date** | 10/26/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 09:33 | **Pump Intake (ft-bmp)** | 345 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:16 | **Volumes Purged** | | **Sample ID** | VRTB-D-S2_10262023 | **Sampled by** | Madison Olender |
| **Sample Time** | 10:06 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:35 | 0 | 0 | 200 | | 0.00 | 8.22 | 0.94 | 0.02 | 1.27 | 12.3 | -141.2 | Clear | None |
| 09:40 | 5 | 5 | 200 | | 0.00 | 7.44 | 0.631 | 0.02 | 0.25 | 12.3 | -145.7 | Clear | None |
| 09:45 | 5 | 10 | 200 | | 0.00 | 7.32 | 0.473 | 0.02 | 0.17 | 12.3 | -134.2 | Clear | None |
| 09:50 | 5 | 15 | 200 | | 0.00 | 7.3 | 0.443 | 0.02 | 0.17 | 12.2 | -129.3 | Clear | None |
| 09:55 | 5 | 20 | 200 | | 0.00 | 7.31 | 0.401 | 0.02 | 0.12 | 12.3 | -127.7 | Clear | None |
| 10:00 | 5 | 25 | 200 | | 0.00 | 7.32 | 0.4 | 0.02 | 0.11 | 12.4 | -129.4 | Clear | None |
| 10:05 | 5 | 30 | 200 | | 0.00 | 7.33 | 0.391 | 0.02 | 0.11 | 12.4 | -127.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-Y3 | | | **Date** | 10/26/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 57.6 degrees F and Fog/Mist. The wind is blowing SE at 5.8 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 10:19 | **Pump Intake (ft-bmp)** | 305 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:10 | **Volumes Purged** | | **Sample ID** | VRTB-D-Y3_10262023 | **Sampled by** | Madison Olender |
| **Sample Time** | 11:00 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:22 | 0 | 0 | 200 | | 0.00 | 7.5 | 0.582 | 0.02 | 1.56 | 12.6 | -46.5 | Clear | None |
| 10:27 | 5 | 5 | 200 | | 0.00 | 7.65 | 0.316 | 0.02 | 0.17 | 12.2 | -81.9 | Clear | None |
| 10:32 | 5 | 10 | 200 | | 0.00 | 7.71 | 0.28 | 0.02 | 0.5 | 12.2 | -98.8 | Clear | None |
| 10:37 | 3 | 15 | 200 | | 0.00 | 7.71 | 0.32 | 0.02 | 0.72 | 12.2 | -99.7 | Clear | None |
| 10:42 | 5 | 20 | 200 | | 0.00 | 7.72 | 0.289 | 0.02 | 0.74 | 12.2 | -99.3 | Clear | None |
| 10:47 | 5 | 25 | 200 | | 0.00 | 7.72 | 0.293 | 0.02 | 0.81 | 12.2 | -97.4 | Clear | None |
| 10:52 | 5 | 30 | 200 | | 0.00 | 7.72 | 0.265 | 0.02 | 0.9 | 12.1 | -95.2 | Clear | None |
| 10:55 | 3 | 33 | 200 | | 0.00 | 7.72 | 0.263 | 0.02 | 0.92 | 12.1 | -94.2 | Clear | None |
| 10:58 | 3 | 36 | 200 | | 0.00 | 7.73 | 0.26 | 0.02 | 0.94 | 12.1 | -93.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-B1 | | | **Date** | 10/26/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 60.8 degrees F and Cloudy. The wind is blowing W at 5.8 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 18:52 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 19:35 | **Volumes Purged** | | **Sample ID** | VRTB-L-B1_10262030 | **Sampled by** | Madison Olender |
| **Sample Time** | 19:25 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:54 | 0 | 0 | 200 | | 0.00 | 7.31 | 0.69 | 2.33 | 0.58 | 13.2 | -9 | Clear | None |
| 18:59 | 5 | 5 | 200 | | 0.00 | 7.54 | 0.438 | 0.02 | 0.07 | 13 | -83.5 | Clear | None |
| 19:04 | 5 | 10 | 200 | | 0.00 | 7.94 | 0.41 | 0.02 | 0.02 | 13 | -152.9 | Clear | None |
| 19:09 | 5 | 15 | 200 | | 0.00 | 8.38 | 0.385 | 0.02 | 0.01 | 12.9 | -219.2 | Clear | None |
| 19:14 | 5 | 20 | 200 | | 0.00 | 8.65 | 0.383 | 0.02 | 0.1 | 12.8 | -254.4 | Clear | None |
| 19:19 | 5 | 25 | 200 | | 0.00 | 8.64 | 0.376 | 0.02 | 0.1 | 12.7 | -259.3 | Clear | None |
| 19:24 | 5 | 30 | 200 | | 0.00 | 8.62 | 0.377 | 0.02 | 0.1 | 12.7 | -263 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-BB8 | | | **Date** | 10/24/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 57.2 degrees F and Mostly Clear. The wind is blowing S/SW at 10.4 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 13:10 | **Pump Intake (ft-bmp)** | 93 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:53 | **Volumes Purged** | | **Sample ID** | VRTB-L-BB8_10242023 | **Sampled by** | Madison Olender |
| **Sample Time** | 13:43 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:12 | 0 | 0 | 200 | | 0.00 | 7.72 | 0.361 | 0.02 | 0.86 | 12.9 | -31.7 | Clear | None |
| 13:17 | 5 | 5 | 200 | | 0.00 | 7.57 | 0.282 | 0.02 | 0.21 | 12.5 | -77.6 | Clear | None |
| 13:22 | 5 | 10 | 200 | | 0.00 | 7.54 | 0.249 | 0.02 | 0.07 | 12.3 | -81.2 | Clear | None |
| 13:27 | 5 | 15 | 200 | | 0.00 | 7.56 | 0.241 | 0.02 | 0.03 | 12.3 | -86.7 | Clear | None |
| 13:32 | 5 | 20 | 200 | | 0.00 | 7.61 | 0.237 | 0.02 | 0.03 | 12.4 | -91.2 | Clear | None |
| 13:37 | 5 | 25 | 200 | | 0.00 | 7.6 | 0.236 | 0.02 | 0.03 | 12.2 | -91.6 | Clear | None |
| 13:42 | 5 | 30 | 200 | | 0.00 | 7.61 | 0.236 | 0.02 | 0.03 | 12.3 | -94 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |
| PFAS | 500 mL Plastic | 6 | None |

**Comments:** DUP-01 collected

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: S. Longsect vault
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival:
Well Locked at Departure:
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-G4 | | | **Date** | 10/26/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 60.8 degrees F and Light Rain. The wind is blowing SW at 9.2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 17:16 | **Pump Intake (ft-bmp)** | 273 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:59 | **Volumes Purged** | | **Sample ID** | VRTB-L-G4_10262023 | **Sampled by** | Madison Olender |
| **Sample Time** | 17:49 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:18 | 0 | 0 | 200 | | 0.00 | 7.71 | 0.338 | 0.02 | 0.77 | 13.3 | -23.1 | Clear | None |
| 17:23 | 5 | 5 | 200 | | 0.00 | 7.5 | 0.264 | 0.02 | 0.61 | 12.9 | -57.7 | Clear | None |
| 17:28 | 5 | 10 | 200 | | 0.00 | 7.54 | 0.254 | 0.02 | 0.85 | 12.8 | -52.9 | Clear | None |
| 17:33 | 5 | 15 | 200 | | 0.00 | 7.57 | 0.253 | 0.02 | 1.07 | 12.8 | -50.9 | Clear | None |
| 17:38 | 5 | 20 | 200 | | 0.00 | 7.59 | 0.253 | 0.02 | 1.1 | 12.7 | -51.1 | Clear | None |
| 17:43 | 5 | 25 | 200 | | 0.00 | 7.6 | 0.252 | 0.02 | 1.12 | 12.7 | -51.7 | Clear | None |
| 17:48 | 5 | 30 | 200 | | 0.00 | 7.61 | 0.253 | 0.02 | 1.12 | 12.8 | -52.8 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-M5 | | | **Date** | 10/23/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 44.6 degrees F and Mostly Cloudy. The wind is blowing S/SE at 6.9 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 16:41 | **Pump Intake (ft-bmp)** | 228 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:35 | **Volumes Purged** | | **Sample ID** | VRTB-L-M5_10232023 | **Sampled by** | Madison Olender |
| **Sample Time** | 17:25 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:44 | 0 | 0 | 200 | | 0.00 | 7.72 | 0.363 | 0.02 | 0.64 | 12.1 | 13.9 | Clear | None |
| 16:49 | 5 | 5 | 200 | | 0.00 | 7.82 | 0.287 | 1.06 | 0.16 | 11.8 | -86.2 | Clear | None |
| 16:54 | 5 | 10 | 200 | | 0.00 | 7.74 | 0.28 | 0.02 | 0 | 11.8 | -86.2 | Clear | None |
| 16:59 | 5 | 15 | 200 | | 0.00 | 7.69 | 0.291 | 0.02 | 0.23 | 11.8 | -84.2 | Clear | None |
| 17:04 | 5 | 20 | 200 | | 0.00 | 7.69 | 0.262 | 0.02 | 0.31 | 11.8 | -84.9 | Clear | None |
| 17:09 | 5 | 25 | 200 | | 0.00 | 7.69 | 0.272 | 0.02 | 0.43 | 11.8 | -86.3 | Clear | None |
| 17:14 | 5 | 30 | 200 | | 0.00 | 7.69 | 0.263 | 0.02 | 0.57 | 11.8 | -85.3 | Clear | None |
| 17:19 | 5 | 35 | 200 | | 0.00 | 7.68 | 0.268 | 0.02 | 0.56 | 11.8 | -85 | Clear | None |
| 17:24 | 5 | 40 | 200 | | 0.00 | 7.7 | 0.27 | 0.02 | 0.56 | 11.8 | -88.1 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-O6 | | | **Date** | 10/24/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 08:39 | **Pump Intake (ft-bmp)** | 183 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:33 | **Volumes Purged** | | **Sample ID** | VRTB-L-O6_10242023 | **Sampled by** | Madison Olender |
| **Sample Time** | 09:23 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:41 | 0 | 0 | 200 | | 0.00 | 7.1 | 0.361 | 0.83 | 0.63 | 12.4 | 31 | Clear | None |
| 08:46 | 5 | 5 | 200 | | 0.00 | 7.59 | 0.345 | | 0.38 | 11.9 | -66.9 | Clear | None |
| 08:51 | 5 | 10 | 200 | | 0.00 | 7.59 | 0.331 | | 0.45 | 11.9 | -78.5 | Clear | None |
| 08:56 | 5 | 15 | 200 | | 0.00 | 7.55 | 0.344 | | 0.64 | 12 | -76.2 | Clear | None |
| 09:01 | 5 | 20 | 200 | | 0.00 | 7.55 | 0.341 | 0.02 | 0.35 | 11.8 | -82.9 | Clear | None |
| 09:06 | 5 | 25 | 200 | | 0.00 | 7.53 | 0.311 | 0.02 | 0.34 | 11.7 | -85.6 | Clear | None |
| 09:11 | 5 | 30 | 200 | | 0.00 | 7.52 | 0.31 | 0.02 | 0.31 | 11.4 | -86.7 | Clear | None |
| 09:16 | 5 | 35 | 200 | | 0.00 | 7.56 | 0.308 | 0.02 | 0.33 | 11.5 | -91.2 | Clear | None |
| 09:21 | 5 | 40 | 200 | | 0.00 | 7.57 | 0.304 | 0.02 | 0.32 | 11.5 | -92.6 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-P7 | | | **Date** | 10/24/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 50.0 degrees F and Light Rain and Fog/Mist. The wind is blowing W/SW at 5.8 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 11:50 | **Pump Intake (ft-bmp)** | 138 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:02 | **Volumes Purged** | | **Sample ID** | VRTB-L-P7_10242023 | **Sampled by** | Madison Olender |
| **Sample Time** | 12:52 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:51 | 0 | 0 | 200 | | 0.00 | 7.48 | 1.13 | 0.02 | 0.73 | 12.5 | 30.9 | Clear | None |
| 11:56 | 5 | 5 | 200 | | 0.00 | 7.64 | 1.16 | 0.02 | 0.15 | 12.2 | -100.8 | Clear | None |
| 12:01 | 5 | 10 | 200 | | 0.00 | 7.64 | 0.502 | 0.02 | 0.09 | 12.3 | -115.8 | Clear | None |
| 12:06 | 5 | 15 | 200 | | 0.00 | 7.67 | 0.383 | 0.02 | 0.05 | 12.3 | -125.7 | Clear | None |
| 12:11 | 5 | 20 | 200 | | 0.00 | 7.78 | 0.356 | 0.02 | 0.02 | 12.4 | -139.6 | Clear | None |
| 12:16 | 5 | 25 | 200 | | 0.00 | 7.82 | 0.374 | 0.02 | 0 | 12.3 | -147.5 | Clear | None |
| 12:21 | 5 | 30 | 200 | | 0.00 | 7.84 | 0.346 | 0.02 | 0 | 12.2 | -154.6 | Clear | None |
| 12:26 | 5 | 35 | 200 | | 0.00 | 7.83 | 0.395 | 0.02 | 0 | 12.2 | -159.6 | Clear | None |
| 12:31 | 5 | 40 | 200 | | 0.00 | 8.01 | 0.318 | 0.02 | 0 | 12.3 | -172.3 | Clear | None |
| 12:36 | 5 | 45 | 200 | | 0.00 | 7.99 | 0.313 | 0.02 | 0 | 12.3 | -177.2 | Clear | None |
| 12:41 | 5 | 50 | 200 | | 0.00 | 7.97 | 0.316 | 0.02 | 0 | 12.3 | -180.4 | Clear | None |
| 12:46 | 5 | 55 | 200 | | 0.00 | 7.99 | 0.308 | 0.02 | 0 | 12.3 | -184.3 | Clear | None |
| 12:51 | 5 | 60 | 200 | | 0.00 | 8 | 0.342 | 0.02 | 0 | 12.3 | -186.5 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-S2 | | | **Date** | 10/26/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 61.0 degrees F and Cloudy. The wind is blowing S/SW at 9.2 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 16:28 | **Pump Intake (ft-bmp)** | 363 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:13 | **Volumes Purged** | | **Sample ID** | VRTB-L-S2_10262023 | **Sampled by** | Madison Olender |
| **Sample Time** | 17:03 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:29 | 0 | 0 | 200 | | 0.00 | 7.03 | 0.85 | 0.02 | 0.89 | 13.3 | 59.6 | Clear | None |
| 16:34 | 5 | 5 | 200 | | 0.00 | 9.88 | 0.376 | 0.02 | 0.04 | 12.8 | -27.5 | Clear | None |
| 16:39 | 5 | 10 | 200 | | 0.00 | 9.79 | 0.363 | 0.02 | 0.05 | 12.8 | -30.9 | Clear | None |
| 16:44 | 5 | 15 | 200 | | 0.00 | 9.55 | 0.339 | 0.02 | 0.1 | 12.5 | -48.5 | Clear | None |
| 16:49 | 5 | 20 | 200 | | 0.00 | 9.48 | 0.336 | 0.02 | 0.1 | 12.8 | -57.8 | Clear | None |
| 16:54 | 5 | 25 | 200 | | 0.00 | 9.44 | 0.33 | 0.02 | 0.1 | 12.8 | -82.4 | Clear | None |
| 16:59 | 5 | 30 | 200 | | 0.00 | 9.38 | 0.328 | 0.02 | 0.1 | 12.7 | -83.9 | Clear | None |
| 17:02 | 3 | 33 | 200 | | 0.00 | 9.36 | 0.327 | 0.02 | 0.1 | 12.8 | -91.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-Y3 | | | **Date** | 10/26/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 18:02 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:50 | **Volumes Purged** | | **Sample ID** | VRTB-L-Y3_10262023 | **Sampled by** | Madison Olender |
| **Sample Time** | 18:40 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:03 | 0 | 0 | 200 | | 0.00 | 7.17 | 0.321 | 0.02 | 0.53 | 13.1 | -28.1 | Clear | None |
| 18:08 | 5 | 5 | 200 | | 0.00 | 7.46 | 0.31 | 0.02 | 1.35 | 12.9 | -27.7 | Clear | None |
| 18:13 | 5 | 10 | 200 | | 0.00 | 7.52 | 0.305 | 0.02 | 3.66 | 12.8 | -17.4 | Clear | None |
| 18:18 | 5 | 15 | 200 | | 0.00 | 7.54 | 0.257 | 0.02 | 5 | 12.7 | -11.4 | Clear | None |
| 18:23 | 5 | 20 | 200 | | 0.00 | 7.56 | 0.286 | 0.02 | 5.1 | 12.8 | -11.5 | Clear | None |
| 18:28 | 5 | 25 | 200 | | 0.00 | 7.6 | 0.278 | 0.02 | 5.25 | 12.8 | -9.2 | Clear | None |
| 18:33 | 5 | 30 | 200 | | 0.00 | 7.59 | 0.303 | 0.02 | 5.6 | 12.7 | -8.1 | Clear | None |
| 18:36 | 3 | 33 | 200 | | 0.00 | 7.59 | 0.302 | 0.02 | 5.63 | 12.8 | -7.3 | Clear | None |
| 18:39 | 3 | 36 | 200 | | 0.00 | 7.59 | 0.302 | 0.02 | 5.69 | 12.8 | -5.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-B1 | | | **Date** | 10/24/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.00 | **Total Depth (ft-bmp)** | 16 | **Water Column (ft)** | 1.00 | **Gallons in Well** | 0.04 |
| **Purge Start** | 14:32 | **Pump Intake (ft-bmp)** | 422 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:26 | **Volumes Purged** | | **Sample ID** | VRTB-S-B1_10242023 | **Sampled by** | Madison Olender |
| **Sample Time** | 15:16 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:34 | 0 | 0 | 200 | | 0.00 | 7.84 | 0.79 | 0.3 | 1.09 | 13.2 | 25.4 | Clear | None |
| 14:39 | 5 | 5 | 200 | | 0.00 | 7.5 | 0.412 | 0.2 | 0.59 | 13 | -17.5 | Clear | None |
| 14:44 | 5 | 10 | 200 | | 0.00 | 7.46 | 0.346 | | 0.71 | 13 | -30.3 | Clear | None |
| 14:49 | 5 | 15 | 200 | | 0.00 | 7.49 | 0.355 | 0.02 | 0.92 | 13 | -43.5 | Clear | None |
| 14:54 | 5 | 20 | 200 | | 0.00 | 7.5 | 0.362 | 0.02 | 1.14 | 13 | -50.6 | Clear | None |
| 14:59 | 5 | 25 | 200 | | 0.00 | 7.5 | 0.36 | 0.02 | 1.37 | 12.9 | -54.1 | Clear | None |
| 15:04 | 5 | 30 | 200 | | 0.00 | 7.5 | 0.433 | 0.02 | 1.64 | 12.9 | -58.7 | Clear | None |
| 15:09 | 5 | 35 | 200 | | 0.00 | 7.5 | 0.423 | 0.02 | 1.97 | 12.9 | -60.4 | Clear | None |
| 15:12 | 3 | 38 | 200 | | 0.00 | 7.51 | 0.418 | 0.02 | 2 | 12.9 | -60.7 | Clear | None |
| 15:15 | 3 | 41 | 200 | | 0.00 | 7.52 | 0.414 | 0.02 | 2.11 | 12.9 | -60.5 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-G4 | | | **Date** | 10/25/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 60.8 degrees F and Light Rain. The wind is blowing W/SW at 3.4 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 09:36 | **Pump Intake (ft-bmp)** | 272 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:40 | **Volumes Purged** | | **Sample ID** | VRTB-S-G4_10252023 | **Sampled by** | Madison Olender |
| **Sample Time** | 10:25 | **Gallons Purged** | | **Replicate/ Code No.** | DUP-02 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:38 | 0 | 0 | 200 | | 0.00 | 7.56 | 0.54 | 0.02 | 0.79 | 13.2 | -5.4 | Clear | None |
| 09:43 | 5 | 5 | 200 | | 0.00 | 7.47 | 0.558 | 0.02 | 2.68 | 13.1 | -21.1 | Clear | None |
| 09:48 | 5 | 10 | 200 | | 0.00 | 7.58 | 0.494 | 0.02 | 2.15 | 13.1 | -28.5 | Clear | None |
| 09:53 | 5 | 15 | 200 | | 0.00 | 7.66 | 0.442 | 0.02 | 2.08 | 13.1 | -32 | Clear | None |
| 09:58 | 5 | 20 | 200 | | 0.00 | 7.75 | 0.423 | 0.02 | 2.33 | 13.1 | -31.2 | Clear | None |
| 10:03 | 5 | 25 | 200 | | 0.00 | 7.81 | 0.41 | 0.02 | 2.38 | 13.1 | -26.5 | Clear | None |
| 10:08 | 5 | 30 | 200 | | 0.00 | 7.86 | 0.404 | 0.02 | 2.15 | 13.1 | -22.8 | Clear | None |
| 10:13 | 5 | 35 | 200 | | 0.00 | 7.9 | 0.409 | 0.02 | 2.81 | 13.1 | -16.9 | Clear | None |
| 10:18 | 5 | 40 | 200 | | 0.00 | 7.93 | 0.407 | 0.02 | 2.92 | 13.1 | -11.1 | Clear | None |
| 10:23 | 5 | 45 | 200 | | 0.00 | 7.95 | 0.402 | 0.02 | 2.94 | 13.1 | -6.9 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 6 | None |

**Comments:** DUP-02

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-M5 | | | **Date** | 10/26/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 13:40 | **Pump Intake (ft-bmp)** | 222 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:42 | **Volumes Purged** | | **Sample ID** | VRTB-S-M5_10262023 | **Sampled by** | Madison Olender |
| **Sample Time** | 14:31 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:44 | 0 | 0 | 200 | | 0.00 | 7.79 | 0.391 | 0.02 | 6.23 | 13.6 | 42.2 | Clear | None |
| 13:49 | 5 | 5 | 200 | | 0.00 | 7.58 | 0.376 | 0.02 | 0.47 | 13.2 | 20.8 | Clear | None |
| 13:54 | 5 | 10 | 200 | | 0.00 | 7.39 | 0.346 | 0.02 | 0.16 | 13.1 | -7.7 | Clear | None |
| 13:59 | 5 | 15 | 200 | | 0.00 | 7.43 | 0.344 | 0.02 | 0.22 | 13.1 | -17.8 | Clear | None |
| 14:04 | 5 | 20 | 200 | | 0.00 | 7.53 | 0.337 | 0.02 | 0.56 | 13 | -19.9 | Clear | None |
| 14:09 | 5 | 25 | 200 | | 0.00 | 7.52 | 0.349 | 0.02 | 0.59 | 13 | -20.1 | Clear | None |
| 14:14 | 5 | 30 | 200 | | 0.00 | 7.55 | 0.348 | 0.02 | 0.77 | 13 | -23.3 | Clear | None |
| 14:19 | 5 | 35 | 200 | | 0.00 | 7.57 | 0.346 | 0.02 | 0.83 | 13 | -25.2 | Clear | None |
| 14:24 | 5 | 40 | 200 | | 0.00 | 7.55 | 0.329 | 0.02 | 1.22 | 13 | -24.2 | Clear | None |
| 14:27 | 3 | 43 | 200 | | 0.00 | 7.56 | 0.328 | 0.02 | 1.27 | 12.9 | -23.6 | Clear | None |
| 14:30 | 3 | 46 | 200 | | 0.00 | 7.55 | 0.327 | 0.02 | 1.3 | 12.9 | -22.7 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-O6 | | | **Date** | 10/26/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 12:22 | **Pump Intake (ft-bmp)** | 172 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:13 | **Volumes Purged** | | **Sample ID** | VRTB-S-O6_10262023 | **Sampled by** | Madison Olender |
| **Sample Time** | 13:03 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:26 | 0 | 0 | 200 | | 0.00 | 7.69 | 0.311 | 0.34 | 7.08 | 13.6 | 26.1 | Clear | None |
| 12:31 | 5 | 5 | 200 | | 0.00 | 7.49 | 0.38 | 0.02 | 0.25 | 13.3 | 6.5 | Clear | None |
| 12:36 | 5 | 10 | 200 | | 0.00 | 7.49 | 0.31 | 0.02 | 1.9 | 13.1 | -12.9 | Clear | None |
| 12:41 | 5 | 15 | 200 | | 0.00 | 7.52 | 0.301 | 0.02 | 0.59 | 13.1 | -19.3 | Clear | None |
| 12:46 | 5 | 20 | 200 | | 0.00 | 7.6 | 0.297 | 0.02 | 1.15 | 13.1 | -20.7 | Clear | None |
| 12:51 | 5 | 25 | 200 | | 0.00 | 7.62 | 0.294 | 0.02 | 1.69 | 13 | -18.5 | Clear | None |
| 12:56 | 5 | 30 | 200 | | 0.00 | 7.63 | 0.293 | 0.02 | 1.71 | 13 | -16.4 | Clear | None |
| 13:01 | 5 | 35 | 200 | | 0.00 | 7.64 | 0.291 | 0.02 | 1.82 | 13.1 | -13.2 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-R7 | | | **Date** | 10/26/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | **Weather(°F)** | | | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 14:44 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:59 | **Volumes Purged** | | **Sample ID** | VTRB-S-R7_10262023 | **Sampled by** | Madison Olender |
| **Sample Time** | 15:49 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:48 | 0 | 0 | 200 | | 0.00 | 7.68 | 1.01 | 0.02 | 4.03 | 13.4 | 23.5 | Clear | None |
| 14:53 | 5 | 5 | 200 | | 0.00 | 7.56 | 0.67 | 0.02 | 0.41 | 13.1 | 2.9 | Clear | None |
| 14:58 | 5 | 10 | 200 | | 0.00 | 7.55 | 0.431 | 0.02 | 0.4 | 13.1 | -3.8 | Clear | None |
| 15:03 | 5 | 15 | 200 | | 0.00 | 7.57 | 0.362 | 0.02 | 0.59 | 13 | -8.4 | Clear | None |
| 15:08 | 5 | 20 | 200 | | 0.00 | 7.53 | 0.355 | 0.02 | 0.85 | 13 | -13 | Clear | None |
| 15:13 | 5 | 25 | 200 | | 0.00 | 7.58 | 0.345 | 0.02 | 1.04 | 13 | -16.2 | Clear | None |
| 15:18 | 5 | 30 | 200 | | 0.00 | 7.59 | 0.341 | 0.02 | 1.26 | 13 | -20.4 | Clear | None |
| 15:23 | 5 | 35 | 200 | | 0.00 | 7.6 | 0.418 | 0.02 | 1.42 | 13 | -23.2 | Clear | None |
| 15:28 | 5 | 40 | 200 | | 0.00 | 7.6 | 0.325 | 0.02 | 1.57 | 13 | -24.8 | Clear | None |
| 15:33 | 5 | 45 | 200 | | 0.00 | 7.61 | 0.325 | 0.02 | 1.74 | 13 | -26.3 | Clear | None |
| 15:36 | 3 | 48 | 200 | | 0.00 | 7.62 | 0.331 | 0.02 | 1.82 | 13.1 | -26.8 | Clear | None |
| 15:39 | 3 | 51 | 200 | | 0.00 | 7.63 | 0.322 | 0.02 | 1.9 | 13.1 | -27.8 | Clear | None |
| 15:44 | 5 | 56 | 200 | | 0.00 | 7.64 | 0.319 | 0.02 | 1.99 | 13.1 | -29 | Clear | None |
| 15:48 | 4 | 60 | 200 | | 0.00 | 7.64 | 0.317 | 0.02 | 2.09 | 13.1 | -29.5 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-S2 | | | **Date** | 10/24/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 57.6 degrees F and Rain and Fog/Mist. The wind is blowing W/SW at 4.7 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 16:28 | **Pump Intake (ft-bmp)** | 372 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:16 | **Volumes Purged** | | **Sample ID** | VRTB-S-S2_10242023 | **Sampled by** | Madison Olender |
| **Sample Time** | 17:06 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:30 | 0 | 0 | 200 | 9,999.00 | 0.00 | 7.74 | 0.518 | 0.02 | 0.93 | 13.1 | -22.7 | Clear | None |
| 16:35 | 5 | 5 | 200 | 9,999.00 | 0.00 | 7.73 | 0.455 | 0.02 | 1.9 | 13 | -40.7 | Clear | None |
| 16:40 | 5 | 10 | 200 | 9,999.00 | 0.00 | 7.63 | 0.395 | 0.02 | 1.45 | 12.9 | -54 | Clear | None |
| 16:45 | 5 | 15 | 200 | 9,999.00 | 0.00 | 7.56 | 0.375 | 0.02 | 0.3 | 12.9 | -60 | Clear | None |
| 16:50 | 5 | 20 | 200 | 9,999.00 | 0.00 | 7.53 | 0.364 | 0.02 | 0.43 | 12.9 | -64.1 | Clear | None |
| 16:55 | 5 | 25 | 200 | 9,999.00 | 0.00 | 7.52 | 0.357 | 0.02 | 1.72 | 12.9 | -65.7 | Clear | None |
| 17:00 | 5 | 30 | 200 | 9,999.00 | 0.00 | 7.53 | 0.353 | 0.02 | 2.47 | 13 | -65.3 | Clear | None |
| 17:03 | 3 | 33 | 200 | 9,999.00 | 0.00 | 7.54 | 0.352 | 0.02 | 2.52 | 13 | -64.3 | Clear | None |
| 17:05 | 2 | 35 | 200 | 9,999.00 | 0.00 | 7.53 | 0.351 | 0.02 | 2.63 | 13 | -63 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location:

Well Locked at Arrival: no

Condition of Well: Good condition

Well Locked at Departure: no

Well Completion: Flush mount

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-Y3 | | | **Date** | 10/24/2023 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 57.2 degrees F and Light Rain. The wind is blowing W at 5.8 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | 1 | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 9,999.00 | **Total Depth (ft-bmp)** | 9999 | **Water Column (ft)** | 0.00 | **Gallons in Well** | 0.00 |
| **Purge Start** | 17:19 | **Pump Intake (ft-bmp)** | 322 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:00 | **Volumes Purged** | | **Sample ID** | VRTB-S-Y3_10242023 | **Sampled by** | Madison Olender |
| **Sample Time** | 18:00 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:21 | 0 | 0 | 200 | 9,999.00 | 0.00 | 7.86 | 0.87 | 1.99 | 2.88 | 13.2 | -2.5 | Clear | None |
| 17:26 | 5 | 5 | 200 | 9,999.00 | 0.00 | 7.79 | 0.88 | 0.02 | 1.49 | 13.1 | -60.4 | Clear | None |

| Constituent Sampled | Container | Number | Preservative |
|---|---|---|---|
| PFAS | 500 mL Plastic | 3 | None |

**Comments:** Well ran dry at 1727. Let recharge, start filling sample bottles as well recharges

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Logs

# Performance Monitoring Event #6

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_2 | | | **Date** | 1/22/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 22.8 degrees F and Cloudy. The wind is blowing SW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.23 | **Total Depth (ft-bmp)** | 16.6 | **Water Column (ft)** | 1.37 | **Gallons in Well** | |
| **Purge Start** | 15:05 | **Pump Intake (ft-bmp)** | 16.55 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:40 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_2_01222024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:35 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:10 | 0 | 0 | 200 | 15.23 | 0.26 | 7.51 | 0.235 | 3.05 | 2.01 | 6.9 | 231.6 | Clear | None |
| 15:15 | 5 | 5 | 200 | 15.23 | 0.53 | 7.53 | 0.232 | 2.55 | 1.82 | 6.8 | 216.3 | Clear | None |
| 15:20 | 5 | 10 | 200 | 15.23 | 0.79 | 7.54 | 0.23 | 2.33 | 1.71 | 6.7 | 206.4 | Clear | None |
| 15:25 | 5 | 15 | 200 | 15.23 | 1.06 | 7.56 | 0.229 | 2.23 | 1.68 | 6.5 | 200.3 | Clear | None |
| 15:30 | 5 | 20 | 200 | 15.23 | 1.32 | 7.58 | 0.228 | 2.19 | 1.66 | 6.6 | 194.5 | Clear | None |
| 15:35 | 5 | 25 | 200 | 15.23 | 1.59 | 7.59 | 0.228 | 2.11 | 1.66 | 6.5 | 191.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_3 | | | **Date** | 1/22/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 24.8 degrees F and Cloudy. The wind is blowing SW at 5.8 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.23 | **Total Depth (ft-bmp)** | 19.5 | **Water Column (ft)** | 4.27 | **Gallons in Well** | |
| **Purge Start** | 15:55 | **Pump Intake (ft-bmp)** | 19.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:25 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_3_01222024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:20 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:00 | 0 | 0 | 200 | 15.23 | 0.26 | 7.76 | 0.226 | 12.59 | 9.26 | 7.5 | 218.3 | Clear | None |
| 16:05 | 5 | 5 | 200 | 15.23 | 0.53 | 7.76 | 0.227 | 7.66 | 9.32 | 7.5 | 225.5 | Clear | None |
| 16:10 | 5 | 10 | 200 | 15.23 | 0.79 | 7.75 | 0.226 | 3.02 | 9.48 | 7.5 | 230.8 | Clear | None |
| 16:15 | 5 | 15 | 200 | 15.23 | 1.06 | 7.75 | 0.226 | 2.81 | 9.47 | 7.6 | 235.4 | Clear | None |
| 16:20 | 5 | 20 | 200 | 15.23 | 1.32 | 7.75 | 0.227 | 2.42 | 9.45 | 7.6 | 235.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_4 | | | **Date** | 1/22/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 24.8 degrees F and Cloudy. The wind is blowing SW at 5.8 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.25 | **Total Depth (ft-bmp)** | 23 | **Water Column (ft)** | 7.75 | **Gallons in Well** | |
| **Purge Start** | 16:35 | **Pump Intake (ft-bmp)** | 23 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:05 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_4_01222024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:00 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:40 | 0 | 0 | 200 | 15.25 | 0.26 | 7.79 | 0.203 | 14.38 | 9.22 | 7.5 | 175.5 | Clear | None |
| 16:45 | 5 | 5 | 200 | 15.25 | 0.53 | 7.79 | 0.203 | 2.55 | 9.26 | 7.5 | 197.1 | Clear | None |
| 16:50 | 5 | 10 | 200 | 15.25 | 0.79 | 7.8 | 0.204 | 2.12 | 9.32 | 7.7 | 213.5 | Clear | None |
| 16:55 | 5 | 15 | 200 | 15.25 | 1.06 | 7.81 | 0.203 | 1.96 | 9.32 | 7.6 | 218.9 | Clear | None |
| 17:00 | 5 | 20 | 200 | 15.25 | 1.32 | 7.81 | 0.203 | 1.63 | 9.33 | 7.5 | 222.5 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_5 | | | **Date** | 1/22/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 26.1 degrees F and Cloudy. The wind is blowing SW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.22 | **Total Depth (ft-bmp)** | 26.5 | **Water Column (ft)** | 11.28 | **Gallons in Well** | |
| **Purge Start** | 17:15 | **Pump Intake (ft-bmp)** | 26.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:40 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_5_01222024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:35 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:20 | 0 | 0 | 200 | 15.25 | 0.26 | 7.81 | 0.197 | 2.96 | 9.3 | 7.5 | 251.3 | Clear | None |
| 17:25 | 5 | 5 | 200 | 15.25 | 0.53 | 7.84 | 0.197 | 2.55 | 9.29 | 7.5 | 253.5 | Clear | None |
| 17:30 | 5 | 10 | 200 | 15.25 | 0.79 | 7.85 | 0.197 | 2.34 | 9.31 | 7.5 | 255.8 | Clear | None |
| 17:35 | 5 | 15 | 200 | 15.25 | 1.06 | 7.86 | 0.198 | 2.04 | 9.32 | 7.6 | 258.5 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_6 | | | **Date** | 1/22/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 26.6 degrees F and Cloudy. The wind is blowing SW at 4.6 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 15.22 | **Total Depth (ft-bmp)** | 30.5 | **Water Column (ft)** | 15.28 | **Gallons in Well** | |
| **Purge Start** | 17:45 | **Pump Intake (ft-bmp)** | 30.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:10 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_6_01222024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:50 | 0 | 0 | 200 | 15.22 | 0.26 | 7.91 | 0.187 | 5.16 | 9.15 | 7.8 | 219 | Clear | None |
| 17:55 | 5 | 5 | 200 | 15.22 | 0.53 | 7.94 | 0.192 | 3.27 | 9.32 | 8.1 | 225.4 | Clear | None |
| 18:00 | 5 | 10 | 200 | 15.22 | 0.79 | 7.97 | 0.191 | 3.07 | 9.35 | 8 | 227.8 | Clear | None |
| 18:05 | 5 | 15 | 200 | 15.22 | 1.06 | 7.98 | 0.191 | 2.78 | 9.45 | 7.9 | 235.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-B1 | | | **Date** | 1/24/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 32.0 degrees F and Fog/Mist. The wind is blowing undefined at 0.0 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 14:00 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:00 | **Volumes Purged** | | **Sample ID** | VRTB-D-B1_01242024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:55 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:05 | 0 | 0 | 200 | 0.00 | 0.26 | 11.97 | 0.936 | 3.97 | 0.41 | 8.2 | -200 | Clear | None |
| 14:10 | 5 | 5 | 200 | 0.00 | 0.53 | 11.88 | 0.616 | 1.74 | 1.34 | 8.3 | -153.1 | Clear | None |
| 14:15 | 5 | 10 | 200 | 0.00 | 0.79 | 11.78 | 0.517 | 1.71 | 2.08 | 8.2 | -128 | Clear | None |
| 14:20 | 5 | 15 | 200 | 0.00 | 1.06 | 11.53 | 0.467 | 1.53 | 2.98 | 8.1 | -101 | Clear | None |
| 14:25 | 5 | 20 | 200 | 0.00 | 1.32 | 11.49 | 0.363 | 1.45 | 3.8 | 8 | -80 | Clear | None |
| 14:30 | 5 | 25 | 200 | 0.00 | 1.59 | 11.37 | 0.333 | 1.41 | 4.22 | 8.1 | -67.4 | Clear | None |
| 14:35 | 5 | 30 | 200 | 0.00 | 1.85 | 11.21 | 0.302 | 1.34 | 4.41 | 8 | -53.1 | Clear | None |
| 14:40 | 5 | 35 | 200 | 0.00 | 2.11 | 11.09 | 0.285 | 1.22 | 4.93 | 7.9 | -44.1 | Clear | None |
| 14:45 | 5 | 40 | 200 | 0.00 | 2.38 | 11.03 | 0.272 | 1.09 | 5.11 | 7.9 | -36.9 | Clear | None |
| 14:50 | 5 | 45 | 200 | 0.00 | 2.64 | 11.01 | 0.272 | 1.18 | 5.16 | 7.8 | -33.3 | Clear | None |
| 14:55 | 5 | 50 | 200 | 0.00 | 2.91 | 10.98 | 0.27 | 1.23 | 5.19 | 7.8 | -29.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-G4 | | | **Date** | 1/24/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 32.0 degrees F and Fog/Mist. The wind is blowing E/SE at 4.6 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 11:05 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:40 | **Volumes Purged** | | **Sample ID** | VRTB-D-G4_01242024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:35 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:10 | 0 | 0 | 200 | 0.00 | 0.26 | 7.6 | 0.174 | 23.44 | 2.21 | 7.8 | -51.7 | Clear | None |
| 11:15 | 5 | 5 | 200 | 0.00 | 0.53 | 7.61 | 0.167 | 10.89 | 3.4 | 7.7 | -45.7 | Clear | None |
| 11:20 | 5 | 10 | 200 | 0.00 | 0.79 | 7.63 | 0.164 | 7.34 | 3.91 | 7.7 | -41.9 | Clear | None |
| 11:25 | 5 | 15 | 200 | 0.00 | 1.06 | 7.65 | 0.16 | 6.91 | 4.84 | 7.7 | -35.2 | Clear | None |
| 11:30 | 5 | 20 | 200 | 0.00 | 1.32 | 7.66 | 0.159 | 6.4 | 4.89 | 7.8 | -32.2 | Clear | None |
| 11:35 | 5 | 25 | 200 | 0.00 | 1.59 | 7.67 | 0.157 | 6.11 | 4.94 | 7.7 | -28.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-M5 | | | **Date** | 1/23/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 26.6 degrees F and Fog/Mist. The wind is blowing E/SE at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 10:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:35 | **Volumes Purged** | | **Sample ID** | VRTB-D-M5_01232024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:30 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:00 | 0 | 0 | 200 | 0.00 | 0.26 | 7.64 | 0.229 | 6.98 | 2.57 | 7.5 | -55.9 | Clear | None |
| 11:05 | 5 | 5 | 200 | 0.00 | 0.53 | 7.8 | 0.231 | 3.68 | 1.29 | 7.5 | -79.7 | Clear | None |
| 11:10 | 5 | 10 | 200 | 0.00 | 0.79 | 7.98 | 0.211 | 3.31 | 1.8 | 7.5 | -90.1 | Clear | None |
| 11:15 | 5 | 15 | 200 | 0.00 | 1.06 | 8.05 | 0.203 | 3.19 | 2.62 | 7.6 | -84.9 | Clear | None |
| 11:20 | 5 | 20 | 200 | 0.00 | 1.32 | 8.07 | 0.201 | 2.92 | 2.69 | 7.4 | -81.2 | Clear | None |
| 11:25 | 5 | 25 | 200 | 0.00 | 1.59 | 8.08 | 0.199 | 2.73 | 2.79 | 7.4 | -79.5 | Clear | None |
| 11:30 | 5 | 30 | 200 | 0.00 | 1.85 | 8.09 | 0.196 | 2.52 | 2.84 | 7.4 | -76.6 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-O6 | | | **Date** | 1/23/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 26.6 degrees F and Fog/Mist. The wind is blowing E/SE at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 10:05 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:45 | **Volumes Purged** | | **Sample ID** | VRTB-D-O6_01232024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:40 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:10 | 0 | 0 | 200 | 0.00 | 0.26 | 7.33 | 0.183 | 3.43 | 2.59 | 7.3 | -15.5 | Clear | None |
| 10:15 | 5 | 5 | 200 | 0.00 | 0.53 | 7.51 | 0.28 | 2.17 | 1.07 | 6.5 | -97.4 | Clear | None |
| 10:20 | 5 | 10 | 200 | 0.00 | 0.79 | 7.51 | 0.247 | 1.98 | 0.64 | 6.5 | -102.4 | Clear | None |
| 10:25 | 5 | 15 | 200 | 0.00 | 1.06 | 7.53 | 0.214 | 1.94 | 0.61 | 6.5 | -102 | Clear | None |
| 10:30 | 5 | 20 | 200 | 0.00 | 1.32 | 7.56 | 0.211 | 1.82 | 0.59 | 6.5 | -98.8 | Clear | None |
| 10:35 | 5 | 25 | 200 | 0.00 | 1.59 | 7.57 | 0.207 | 1.56 | 0.57 | 6.5 | -94.8 | Clear | None |
| 10:40 | 5 | 30 | 200 | 0.00 | 1.85 | 7.6 | 0.206 | 1.51 | 0.55 | 6.4 | -90.1 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-P8 | | | **Date** | 1/23/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 26.6 degrees F and Cloudy. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 08:00 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:00 | **Volumes Purged** | | **Sample ID** | VRTB-D-P8_01232024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 08:55 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:05 | 0 | 0 | 200 | 0.00 | 0.26 | 11.73 | 1.09 | 3.83 | 1.19 | 7.3 | 124.3 | Clear | None |
| 08:10 | 5 | 5 | 200 | 0.00 | 0.53 | 11.77 | 0.616 | 3.36 | 3.45 | 7.2 | 102.9 | Clear | None |
| 08:15 | 5 | 10 | 200 | 0.00 | 0.79 | 11.63 | 0.429 | 3.16 | 4.52 | 7.3 | 104.8 | Clear | None |
| 08:20 | 5 | 15 | 200 | 0.00 | 1.06 | 11.41 | 0.308 | 2.9 | 5.53 | 7.3 | 110.2 | Clear | None |
| 08:25 | 5 | 20 | 200 | 0.00 | 1.32 | 11.13 | 0.231 | 2.89 | 6.23 | 7.1 | 118.1 | Clear | None |
| 08:30 | 5 | 25 | 200 | 0.00 | 1.59 | 10.91 | 0.199 | 2.71 | 6.62 | 7.2 | 123.8 | Clear | None |
| 08:35 | 5 | 30 | 200 | 0.00 | 1.85 | 10.83 | 0.19 | 2.67 | 6.73 | 7.1 | 125.5 | Clear | None |
| 08:40 | 5 | 35 | 200 | 0.00 | 2.11 | 10.73 | 0.181 | 2.61 | 6.86 | 7.1 | 126.8 | Clear | None |
| 08:45 | 5 | 40 | 200 | 0.00 | 2.38 | 10.7 | 0.178 | 2.68 | 6.91 | 7 | 127.4 | Clear | None |
| 08:50 | 5 | 45 | 200 | 0.00 | 2.64 | 10.67 | 0.175 | 2.57 | 6.98 | 7 | 126.4 | Clear | None |
| 08:55 | 5 | 50 | 200 | 0.00 | 2.91 | 10.66 | 0.173 | 2.5 | 7.02 | 6.9 | 124.1 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-R7 | | | **Date** | 1/23/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 26.6 degrees F and Cloudy. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 09:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:55 | **Volumes Purged** | | **Sample ID** | VRTB-D-R7_01232024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:50 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:20 | 0 | 0 | 200 | 0.00 | 0.26 | 7.52 | 0.323 | 1.89 | 2.04 | 7.2 | -136.7 | Clear | None |
| 09:25 | 5 | 5 | 200 | 0.00 | 0.53 | 7.54 | 0.293 | 1.81 | 1.22 | 6.3 | -141.1 | Clear | None |
| 09:30 | 5 | 10 | 200 | 0.00 | 0.79 | 7.51 | 0.235 | 1.73 | 0.29 | 5.9 | -143.4 | Clear | None |
| 09:35 | 5 | 15 | 200 | 0.00 | 1.06 | 7.49 | 0.215 | 1.71 | 0.22 | 5.8 | -144.6 | Clear | None |
| 09:40 | 5 | 20 | 200 | 0.00 | 1.32 | 7.48 | 0.207 | 1.58 | 0.2 | 5.9 | -144.8 | Clear | None |
| 09:45 | 5 | 25 | 200 | 0.00 | 1.59 | 7.49 | 0.205 | 1.51 | 0.19 | 5.9 | -144.5 | Clear | None |
| 09:50 | 5 | 30 | 200 | 0.00 | 1.85 | 7.49 | 0.202 | 1.59 | 0.19 | 5.9 | -143.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-S2 | | | **Date** | 1/24/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 32.0 degrees F and Fog/Mist. The wind is blowing undefined at 0.0 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 13:10 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:50 | **Volumes Purged** | | **Sample ID** | VRTB-D-S2_01242024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:45 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:15 | 0 | 0 | 200 | 0.00 | 0.26 | 7.41 | 0.271 | 7.63 | 0.29 | 8.2 | -113.2 | Clear | None |
| 13:20 | 5 | 5 | 200 | 0.00 | 0.53 | 7.4 | 0.259 | 3.59 | 0.21 | 8.1 | -115 | Clear | None |
| 13:25 | 5 | 10 | 200 | 0.00 | 0.79 | 7.41 | 0.255 | 2.94 | 0.19 | 8.1 | -117.3 | Clear | None |
| 13:30 | 5 | 15 | 200 | 0.00 | 1.06 | 7.42 | 0.251 | 2.71 | 0.18 | 8.1 | -119.6 | Clear | None |
| 13:35 | 5 | 20 | 200 | 0.00 | 1.32 | 7.42 | 0.248 | 1.56 | 0.17 | 8.1 | -121.4 | Clear | None |
| 13:40 | 5 | 25 | 200 | 0.00 | 1.59 | 7.43 | 0.246 | 1.42 | 0.17 | 8.2 | -122.2 | Clear | None |
| 13:45 | 5 | 30 | 200 | 0.00 | 1.85 | 7.44 | 0.243 | 1.24 | 0.17 | 8.2 | -123.9 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-Y3 | | | **Date** | 1/24/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 32.0 degrees F and Fog/Mist. The wind is blowing SE at 3.4 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 12:20 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:50 | **Volumes Purged** | | **Sample ID** | VRTB-D-Y3_01242024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:45 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:25 | 0 | 0 | 200 | 0.00 | 0.26 | 7.82 | 0.198 | 16.27 | 2.57 | 8.4 | -102.3 | Clear | None |
| 12:30 | 5 | 5 | 200 | 0.00 | 0.53 | 7.82 | 0.197 | 10.98 | 2.65 | 8.4 | -101.4 | Clear | None |
| 12:35 | 5 | 10 | 200 | 0.00 | 0.79 | 7.83 | 0.195 | 9.86 | 2.77 | 8.4 | -99 | Clear | None |
| 12:40 | 5 | 15 | 200 | 0.00 | 1.06 | 7.84 | 0.193 | 9.13 | 2.84 | 8.3 | -98.1 | Clear | None |
| 12:45 | 5 | 20 | 200 | 0.00 | 1.32 | 7.85 | 0.191 | 8.89 | 2.88 | 8.3 | -97.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-B1 | | | **Date** | 1/25/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 30.2 degrees F and Fog/Mist. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 13:30 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:10 | **Volumes Purged** | | **Sample ID** | VRTB-L-B1_01252024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:40 | 0 | 0 | 200 | 0.00 | 0.53 | 8.31 | 0.256 | 4.93 | 0.14 | 8.8 | -221.6 | Clear | None |
| 13:45 | 5 | 5 | 200 | 0.00 | 0.79 | 8.54 | 0.249 | 3.83 | 0.1 | 8.9 | -248.9 | Clear | None |
| 13:50 | 5 | 10 | 200 | 0.00 | 1.06 | 8.61 | 0.244 | 3.09 | 0.1 | 8.8 | -254.6 | Clear | None |
| 13:55 | 5 | 15 | 200 | 0.00 | 1.32 | 8.68 | 0.241 | 2.46 | 0.09 | 8.8 | -266.9 | Clear | None |
| 14:00 | 5 | 20 | 200 | 0.00 | 1.59 | 8.74 | 0.236 | 2.22 | 0.09 | 8.7 | -274.1 | Clear | None |
| 14:05 | 5 | 25 | 200 | 0.00 | 1.85 | 8.75 | 0.236 | 2.11 | 0.09 | 8.8 | -276 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

| | | | |
|---|---|---|---|
| Well Location: | See figure. | Well Locked at Arrival: | no |
| Condition of Well: | Good condition | Well Locked at Departure: | no |
| Well Completion: | Flush mount | Key Number To Well: | NA |

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-BB8 | | | **Date** | 1/23/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 30.2 degrees F and Light Snow and Fog/Mist. The wind is blowing E at 8.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 16:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:05 | **Volumes Purged** | | **Sample ID** | VRTB-L-BB8_01232024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:00 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:40 | 0 | 0 | 200 | 0.00 | 0.26 | 7.53 | 0.215 | 3.04 | 3.75 | 8 | 36.4 | Clear | None |
| 16:45 | 5 | 5 | 200 | 0.00 | 0.53 | 7.62 | 0.216 | 2.88 | 4.16 | 8.1 | 51.9 | Clear | None |
| 16:50 | 5 | 10 | 200 | 0.00 | 0.79 | 7.63 | 0.216 | 2.18 | 4.22 | 8.1 | 58.9 | Clear | None |
| 16:55 | 5 | 15 | 200 | 0.00 | 1.06 | 7.64 | 0.217 | 1.93 | 4.26 | 8.1 | 60.7 | Clear | None |
| 17:00 | 5 | 20 | 200 | 0.00 | 1.32 | 7.65 | 0.217 | 1.64 | 4.32 | 8.1 | 66 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot

1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.

Condition of Well: Good condition

Well Completion: Flush mount

Well Locked at Arrival: no

Well Locked at Departure: no

Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute

mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter

mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-G4 | | | **Date** | 1/25/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 30.2 degrees F and Fog/Mist. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 11:00 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:35 | **Volumes Purged** | | **Sample ID** | VRTB-L-G4_01252024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:25 | **Gallons Purged** | | **Replicate/ Code No.** | DUP-02_01252024 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:05 | 0 | 0 | 200 | 0.00 | 0.26 | 7.79 | 0.204 | 3.71 | 1.36 | 8.2 | 54.2 | Clear | None |
| 11:10 | 5 | 5 | 200 | 0.00 | 0.53 | 7.83 | 0.2 | 3.46 | 1.82 | 8.2 | 58.1 | Clear | None |
| 11:15 | 5 | 10 | 200 | 0.00 | 0.79 | 7.82 | 0.2 | 3.11 | 1.96 | 8.5 | 53 | Clear | None |
| 11:20 | 5 | 15 | 200 | 0.00 | 1.06 | 7.83 | 0.2 | 2.83 | 2 | 8.5 | 48.7 | Clear | None |
| 11:25 | 5 | 20 | 200 | 0.00 | 1.32 | 7.83 | 0.2 | 2.62 | 2.04 | 8.5 | 45.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-M5 | | | **Date** | 1/24/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 29.7 degrees F and Light Snow and Fog/Mist. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 09:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:10 | **Volumes Purged** | | **Sample ID** | VRTB-L-M5_01242024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:30 | 0 | 0 | 200 | 0.00 | 0.26 | 7.64 | 0.214 | 7.43 | 0.35 | 7.7 | -64.9 | Clear | None |
| 09:35 | 5 | 5 | 200 | 0.00 | 0.53 | 7.67 | 0.211 | 4.37 | 0.25 | 7.7 | -68.2 | Clear | None |
| 09:40 | 5 | 10 | 200 | 0.00 | 0.79 | 7.68 | 0.209 | 2.33 | 0.33 | 7.8 | -66.9 | Clear | None |
| 09:45 | 5 | 15 | 200 | 0.00 | 1.06 | 7.69 | 0.209 | 2.11 | 0.44 | 7.8 | -66.2 | Clear | None |
| 09:50 | 5 | 20 | 200 | 0.00 | 1.32 | 7.7 | 0.208 | 1.88 | 0.53 | 7.9 | -66.1 | Clear | None |
| 09:55 | 5 | 25 | 200 | 0.00 | 1.59 | 7.7 | 0.208 | 1.43 | 0.63 | 7.9 | -66.2 | Clear | None |
| 10:00 | 5 | 30 | 200 | 0.00 | 1.85 | 7.7 | 0.208 | 1.29 | 0.67 | 7.9 | -65.6 | Clear | None |
| 10:05 | 5 | 35 | 200 | 0.00 | 2.11 | 7.7 | 0.208 | 1.21 | 0.69 | 7.7 | -65.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-O6 | | | **Date** | 1/24/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 29.7 degrees F and Light Snow and Fog/Mist. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 08:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:15 | **Volumes Purged** | | **Sample ID** | VRTB-L-O6_01242024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:10 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:45 | 0 | 0 | 200 | 0.00 | 0.26 | 7.59 | 0.206 | 10.52 | 1.58 | 8 | -58.9 | Clear | None |
| 08:50 | 5 | 5 | 200 | 0.00 | 0.53 | 7.57 | 0.206 | 8.78 | 1.69 | 8 | -50.2 | Clear | None |
| 08:55 | 5 | 10 | 200 | 0.00 | 0.79 | 7.55 | 0.204 | 6.51 | 1.98 | 8 | -35.2 | Clear | None |
| 09:00 | 5 | 15 | 200 | 0.00 | 1.06 | 7.54 | 0.203 | 3.88 | 2.13 | 7.9 | -27.7 | Clear | None |
| 09:05 | 5 | 20 | 200 | 0.00 | 1.32 | 7.54 | 0.203 | 3.24 | 2.15 | 7.9 | -23.1 | Clear | None |
| 09:10 | 5 | 25 | 200 | 0.00 | 1.59 | 7.55 | 0.202 | 2.89 | 2.19 | 7.9 | -20.1 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-P7 | | | **Date** | 1/23/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 29.7 degrees F and Light Snow and Fog/Mist. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 17:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:50 | **Volumes Purged** | | **Sample ID** | VRTB-L-P7_01232024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:45 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:20 | 0 | 0 | 200 | 0.00 | 0.26 | 7.64 | 0.304 | 11.22 | 0.25 | 7.5 | -136 | Clear | None |
| 17:25 | 5 | 5 | 200 | 0.00 | 0.53 | 7.75 | 0.239 | 6.43 | 0.22 | 7.6 | -151.8 | Clear | None |
| 17:30 | 5 | 10 | 200 | 0.00 | 0.79 | 7.84 | 0.233 | 2.73 | 0.2 | 7.6 | -162.4 | Clear | None |
| 17:35 | 5 | 15 | 200 | 0.00 | 1.06 | 7.88 | 0.229 | 2.28 | 0.2 | 7.6 | -170.3 | Clear | None |
| 17:40 | 5 | 20 | 200 | 0.00 | 1.32 | 7.91 | 0.227 | 2.01 | 0.19 | 7.6 | -174.6 | Clear | None |
| 17:45 | 5 | 25 | 200 | 0.00 | 1.59 | 7.93 | 0.225 | 1.88 | 0.19 | 7.6 | -178.9 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-S2 | | | **Date** | 1/25/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 30.2 degrees F and Fog/Mist. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 12:30 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:10 | **Volumes Purged** | | **Sample ID** | VRTB-L-S2_01252024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:55 | **Gallons Purged** | | **Replicate/ Code No.** | MS/MSD | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:35 | 0 | 0 | 200 | 0.00 | 0.26 | 10.68 | 0.253 | 13.14 | 0.39 | 8.8 | -89.7 | Clear | None |
| 12:40 | 5 | 5 | 200 | 0.00 | 0.53 | 9.95 | 0.211 | 4.82 | 0.24 | 8.8 | -105 | Clear | None |
| 12:45 | 5 | 10 | 200 | 0.00 | 0.79 | 9.73 | 0.207 | 4.12 | 0.21 | 8.9 | -121.9 | Clear | None |
| 12:50 | 5 | 15 | 200 | 0.00 | 1.06 | 9.7 | 0.205 | 3.76 | 0.2 | 8.8 | -125.9 | Clear | None |
| 12:55 | 5 | 20 | 200 | 0.00 | 1.32 | 9.68 | 0.204 | 3.39 | 0.19 | 8.8 | -129.9 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-Y3 | | | **Date** | 1/25/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 30.2 degrees F and Fog/Mist. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 11:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:25 | **Volumes Purged** | | **Sample ID** | VRTB-L-Y3_01252024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:20 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:00 | 0 | 0 | 200 | 0.00 | 0.26 | 7.81 | 0.222 | 2.42 | 7.23 | 8.7 | 60.6 | Clear | None |
| 12:05 | 5 | 5 | 200 | 0.00 | 0.53 | 7.8 | 0.196 | 2.04 | 8.04 | 8.6 | 74.8 | Clear | None |
| 12:10 | 5 | 10 | 200 | 0.00 | 0.79 | 7.78 | 0.194 | 1.91 | 8.24 | 8.7 | 85.4 | Clear | None |
| 12:15 | 5 | 15 | 200 | 0.00 | 1.06 | 7.78 | 0.193 | 1.69 | 8.29 | 8.7 | 89 | Clear | None |
| 12:20 | 5 | 20 | 200 | 0.00 | 1.32 | 7.78 | 0.193 | 1.55 | 8.35 | 8.6 | 91.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-B1 | | | **Date** | 1/23/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 30.2 degrees F and Light Snow and Fog/Mist. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 15:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | | **Volumes Purged** | | **Sample ID** | VRTB-S-B1_01232024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:10 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:30 | 0 | 0 | 200 | 0.00 | 0.26 | 7.67 | 0.292 | 12.24 | 0.33 | 7.5 | -24.8 | Clear | None |
| 15:35 | 5 | 5 | 200 | 0.00 | 0.53 | 7.67 | 0.278 | 4.39 | 0.67 | 7.6 | -39.1 | Clear | None |
| 15:40 | 5 | 10 | 200 | 0.00 | 0.79 | 7.67 | 0.273 | 3.61 | 0.96 | 7.6 | -39.1 | Clear | None |
| 15:45 | 5 | 15 | 200 | 0.00 | 1.06 | 7.66 | 0.268 | 2.78 | 1.42 | 7.6 | -35.5 | Clear | None |
| 15:50 | 5 | 20 | 200 | 0.00 | 1.32 | 7.66 | 0.262 | 1.94 | 1.81 | 7.7 | -31.2 | Clear | None |
| 15:55 | 5 | 25 | 200 | 0.00 | 1.59 | 7.65 | 0.259 | 1.84 | 2.29 | 7.6 | -22.6 | Clear | None |
| 16:00 | 5 | 30 | 200 | 0.00 | 1.85 | 7.65 | 0.253 | 1.71 | 2.71 | 7.6 | -17.3 | Clear | None |
| 16:05 | 5 | 35 | 200 | 0.00 | 2.11 | 7.65 | 0.252 | 1.52 | 2.79 | 7.6 | -15.1 | Clear | None |
| 16:10 | 5 | 40 | 200 | 0.00 | 2.38 | 7.65 | 0.25 | 1.26 | 2.87 | 7.6 | -9.6 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-G4 | | | **Date** | 1/23/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 28.4 degrees F and Fog/Mist. The wind is blowing E/SE at 8.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 12:10 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:00 | **Volumes Purged** | | **Sample ID** | VRTB-S-G4_01232024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:55 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:20 | 0 | 0 | 200 | 0.00 | 0.53 | 7.83 | 0.25 | 4.11 | 0.84 | 7.5 | 34.2 | Clear | None |
| 12:25 | 5 | 5 | 200 | 0.00 | 0.79 | 7.95 | 0.238 | 3.02 | 1.96 | 7.5 | 37.2 | Clear | None |
| 12:30 | 5 | 10 | 200 | 0.00 | 1.06 | 7.99 | 0.232 | 2.46 | 2.61 | 7.3 | 42.5 | Clear | None |
| 12:35 | 5 | 15 | 200 | 0.00 | 1.32 | 8.04 | 0.225 | 2.31 | 3.44 | 7.1 | 52.7 | Clear | None |
| 12:40 | 5 | 20 | 200 | 0.00 | 1.59 | 8.06 | 0.22 | 2.21 | 3.75 | 6.9 | 58.9 | Clear | None |
| 12:45 | 5 | 25 | 200 | 0.00 | 1.85 | 8.06 | 0.217 | 2.02 | 3.92 | 6.7 | 63.6 | Clear | None |
| 12:50 | 5 | 30 | 200 | 0.00 | 2.11 | 8.06 | 0.215 | 1.96 | 3.96 | 6.6 | 65.6 | Clear | None |
| 12:55 | 5 | 35 | 200 | 0.00 | 2.38 | 8.06 | 0.214 | 1.68 | 4.06 | 6.6 | 70.1 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-M5 | | | **Date** | 1/25/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 30.2 degrees F and Fog/Mist. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 10:05 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:40 | **Volumes Purged** | | **Sample ID** | VRTB-S-M5_01252024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:35 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:10 | 0 | 0 | 200 | 0.00 | 0.26 | 7.67 | 0.273 | 4.87 | 1.39 | 6 | 37.1 | Clear | None |
| 10:15 | 5 | 5 | 200 | 0.00 | 0.53 | 7.62 | 0.254 | 3.45 | 0.18 | 6.4 | 9.2 | Clear | None |
| 10:20 | 5 | 10 | 200 | 0.00 | 0.79 | 7.61 | 0.249 | 3.23 | 0.16 | 6.5 | 8.7 | Clear | None |
| 10:25 | 5 | 15 | 200 | 0.00 | 1.06 | 7.6 | 0.243 | 2.36 | 0.15 | 6.5 | 8.1 | Clear | None |
| 10:30 | 5 | 20 | 200 | 0.00 | 1.32 | 7.59 | 0.245 | 2.2 | 0.14 | 6.5 | 7.7 | Clear | None |
| 10:35 | 5 | 25 | 200 | 0.00 | 1.59 | 7.59 | 0.245 | 2.2 | 0.14 | 6.5 | 5.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-O6 | | | **Date** | 1/25/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 30.2 degrees F and Fog/Mist. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 09:10 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:55 | **Volumes Purged** | | **Sample ID** | VRTB-S-O6_01252024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:50 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:15 | 0 | 0 | 200 | 0.00 | 0.26 | 7.76 | 0.231 | 4.48 | 0.34 | 6.6 | 8.7 | Clear | None |
| 09:20 | 5 | 5 | 200 | 0.00 | 0.53 | 7.77 | 0.219 | 2.18 | 0.55 | 6.6 | 16.9 | Clear | None |
| 09:25 | 5 | 10 | 200 | 0.00 | 0.79 | 7.79 | 0.214 | 1.87 | 1.09 | 6.7 | 29.7 | Clear | None |
| 09:30 | 5 | 15 | 200 | 0.00 | 1.06 | 7.83 | 0.203 | 1.8 | 2.63 | 6.5 | 59.3 | Clear | None |
| 09:35 | 5 | 20 | 200 | 0.00 | 1.32 | 7.85 | 0.199 | 1.71 | 3.34 | 6.4 | 73.7 | Clear | None |
| 09:40 | 5 | 25 | 200 | 0.00 | 1.59 | 7.86 | 0.195 | 1.63 | 3.97 | 6.4 | 84.3 | Clear | None |
| 09:45 | 5 | 30 | 200 | 0.00 | 1.85 | 7.88 | 0.192 | 1.51 | 4.11 | 6.4 | 87.4 | Clear | None |
| 09:50 | 5 | 35 | 200 | 0.00 | 2.11 | 7.88 | 0.191 | 1.46 | 4.13 | 6.5 | 89.9 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-P8 | | | **Date** | 1/24/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 32.0 degrees F and Fog/Mist. The wind is blowing undefined at 0.0 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 15:10 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | | **Volumes Purged** | | **Sample ID** | VRTB-S-P8_01242024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:35 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:15 | 0 | 0 | 200 | 0.00 | 0.26 | 11.85 | 0.426 | 15.77 | 9.13 | 4.7 | -27.2 | Clear | None |
| 15:20 | 5 | 5 | 200 | 0.00 | 0.53 | 11.86 | 0.425 | 11.23 | 9.53 | 4.3 | -27.6 | Clear | None |
| 15:25 | 5 | 10 | 200 | 0.00 | 0.79 | 11.85 | 0.421 | 11.19 | 9.59 | 4.1 | -27.5 | Clear | None |
| 15:30 | 5 | 15 | 200 | 0.00 | 1.06 | 11.84 | 0.417 | 10.98 | 9.52 | 4.1 | -27.1 | Clear | None |
| 15:35 | 5 | 20 | 200 | 0.00 | 1.32 | 11.81 | 0.411 | 10.98 | 9.59 | 4.2 | -26.9 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-R7 | | | **Date** | 1/25/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 30.7 degrees F and Fog. The wind is blowing undefined at 0.0 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 08:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 08:55 | **Volumes Purged** | | **Sample ID** | VRTB-S-R7_01252024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 08:45 | **Gallons Purged** | | **Replicate/ Code No.** | DUP-01_01252024 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:20 | 0 | 0 | 200 | 0.00 | 0.26 | 7.73 | 0.278 | 21.17 | 1.22 | 6.4 | 198.2 | Clear | None |
| 08:25 | 5 | 5 | 200 | 0.00 | 0.53 | 7.71 | 0.273 | 7.82 | 1.3 | 6.4 | 198.9 | Clear | None |
| 08:30 | 5 | 10 | 200 | 0.00 | 0.79 | 7.71 | 0.272 | 4.49 | 1.38 | 6.5 | 198.4 | Clear | None |
| 08:35 | 5 | 15 | 200 | 0.00 | 1.06 | 7.72 | 0.269 | 4.14 | 1.43 | 6.4 | 196.3 | Clear | None |
| 08:40 | 5 | 20 | 200 | 0.00 | 1.32 | 7.72 | 0.268 | 3.78 | 1.45 | 6.3 | 194.8 | Clear | None |
| 08:45 | 5 | 25 | 200 | 0.00 | 1.59 | 7.72 | 0.268 | 3.33 | 1.47 | 6.3 | 192.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-S2 | | | **Date** | 1/23/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 28.4 degrees F and Fog/Mist. The wind is blowing E/SE at 8.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 14:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:15 | **Volumes Purged** | | **Sample ID** | VRTB-S-S2_01232024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:10 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:30 | 0 | 0 | 200 | 0.00 | 0.26 | 7.76 | 0.246 | 3.5 | 0.85 | 7.6 | -6.1 | Clear | None |
| 14:35 | 5 | 5 | 200 | 0.00 | 0.53 | 7.72 | 0.248 | 2.96 | 0.21 | 7.8 | -14.1 | Clear | None |
| 14:40 | 5 | 10 | 200 | 0.00 | 0.79 | 7.68 | 0.246 | 2.01 | 0.98 | 7.7 | -2.7 | Clear | None |
| 14:45 | 5 | 15 | 200 | 0.00 | 1.06 | 7.63 | 0.243 | 1.44 | 1.74 | 7.6 | -0.5 | Clear | None |
| 14:50 | 5 | 20 | 200 | 0.00 | 1.32 | 7.62 | 0.242 | 1.49 | 2.32 | 7.6 | 9.7 | Clear | None |
| 14:55 | 5 | 25 | 200 | 0.00 | 1.59 | 7.62 | 0.241 | 1.31 | 2.68 | 7.6 | 17.5 | Clear | None |
| 15:00 | 5 | 30 | 200 | 0.00 | 1.85 | 7.62 | 0.24 | 1.27 | 2.73 | 7.5 | 21.4 | Clear | None |
| 15:05 | 5 | 35 | 200 | 0.00 | 2.11 | 7.61 | 0.238 | 1.23 | 2.79 | 7.4 | 25.6 | Clear | None |
| 15:10 | 5 | 40 | 200 | 0.00 | 2.38 | 7.61 | 0.236 | 1.2 | 2.84 | 7.4 | 28.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-Y3 | | | **Date** | 1/23/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 28.4 degrees F and Fog/Mist. The wind is blowing E/SE at 8.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 13:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:15 | **Volumes Purged** | | **Sample ID** | VRTB-S-Y3_01232024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:10 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:30 | 0 | 0 | 200 | 0.00 | 0.26 | 8.15 | 0.449 | 71.73 | 0.99 | 7.6 | -127.5 | Clear | None |
| 13:35 | 5 | 5 | 200 | 0.00 | 0.53 | 8.1 | 0.408 | 67.6 | 1.11 | 7.6 | -134.5 | Clear | None |
| 13:40 | 5 | 10 | 200 | 0.00 | 0.79 | 8.02 | 0.372 | 55.85 | 1.23 | 7.5 | -127.4 | Clear | None |
| 13:45 | 5 | 15 | 200 | 0.00 | 1.06 | 7.99 | 0.364 | 51.1 | 1.35 | 7.5 | -121.1 | Clear | None |
| 13:50 | 5 | 20 | 200 | 0.00 | 1.32 | 7.96 | 0.355 | 45.61 | 1.42 | 7.4 | -114.5 | Clear | None |
| 13:55 | 5 | 25 | 200 | 0.00 | 1.59 | 7.94 | 0.344 | 42.99 | 1.49 | 7.4 | -112.2 | Clear | None |
| 14:00 | 5 | 30 | 200 | 0.00 | 1.85 | 7.92 | 0.337 | 40.07 | 1.69 | 7.2 | -107.7 | Clear | None |
| 14:05 | 5 | 35 | 200 | 0.00 | 2.11 | 7.92 | 0.334 | 39.27 | 1.73 | 7.2 | -105.7 | Clear | None |
| 14:10 | 5 | 40 | 200 | 0.00 | 2.38 | 7.91 | 0.328 | 37.89 | 1.79 | 7.1 | -101.7 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Logs

# Performance Monitoring Event #7

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_1 | | | **Date** | 4/1/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 42.1 degrees F and Mostly Clear. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 14.50 | **Total Depth (ft-bmp)** | 15 | **Water Column (ft)** | 0.50 | **Gallons in Well** | |
| **Purge Start** | 12:35 | **Pump Intake (ft-bmp)** | 15 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:15 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_1_04012024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:40 | 0 | 0 | 200 | 14.50 | 0.26 | 8.41 | 0.085 | 5.63 | 11.7 | 7.5 | 163 | Clear | None |
| 12:45 | 5 | 5 | 200 | 14.50 | 0.53 | 8.42 | 0.086 | 4.91 | 11.63 | 7.6 | 162.6 | Clear | None |
| 12:50 | 5 | 10 | 200 | 14.50 | 0.79 | 8.42 | 0.086 | 4.44 | 11.69 | 7.4 | 160.4 | Clear | None |
| 12:55 | 5 | 15 | 200 | 14.50 | 1.06 | 8.43 | 0.086 | 3.11 | 11.6 | 7.4 | 158.9 | Clear | None |
| 13:00 | 5 | 20 | 200 | 14.50 | 1.32 | 8.43 | 0.087 | 2.89 | 11.52 | 7.5 | 157.2 | Clear | None |
| 13:05 | 5 | 25 | 200 | 14.50 | 1.59 | 8.44 | 0.088 | 2.72 | 11.52 | 7.5 | 154.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_2 | | | **Date** | 4/1/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 42.1 degrees F and Mostly Clear. The wind is blowing E at 6.9 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 14.05 | **Total Depth (ft-bmp)** | 17 | **Water Column (ft)** | 2.95 | **Gallons in Well** | |
| **Purge Start** | 13:50 | **Pump Intake (ft-bmp)** | 16.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:25 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_2_04012024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:15 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:55 | 0 | 0 | 200 | 14.05 | 0.26 | 7.69 | 0.246 | 2.66 | 2.48 | 7.9 | 141.6 | Clear | None |
| 14:00 | 5 | 5 | 200 | 14.05 | 0.53 | 7.69 | 0.244 | 2.18 | 2.97 | 7.7 | 139.5 | Clear | None |
| 14:05 | 5 | 10 | 200 | 14.05 | 0.79 | 7.69 | 0.242 | 1.84 | 3.26 | 7.7 | 138.2 | Clear | None |
| 14:10 | 5 | 15 | 200 | 14.05 | 1.06 | 7.69 | 0.241 | 1.57 | 3.26 | 7.8 | 135.9 | Clear | None |
| 14:15 | 5 | 20 | 200 | 14.05 | 1.32 | 7.7 | 0.239 | 1.41 | 3.25 | 7.8 | 133.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_3 | | | **Date** | 4/1/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 45.1 degrees F and Partly Cloudy. The wind is blowing S/SE at 6.9 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 14.05 | **Total Depth (ft-bmp)** | 19.5 | **Water Column (ft)** | 5.45 | **Gallons in Well** | |
| **Purge Start** | 14:50 | **Pump Intake (ft-bmp)** | 19 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:25 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_3_04012024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:15 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:55 | 0 | 0 | 200 | 14.05 | 0.26 | 7.89 | 0.203 | 7.83 | 9.56 | 8.4 | 140.2 | Clear | None |
| 15:00 | 5 | 5 | 200 | 14.05 | 0.53 | 7.89 | 0.204 | 4.52 | 9.62 | 8.4 | 139.7 | Clear | None |
| 15:05 | 5 | 10 | 200 | 14.05 | 0.79 | 7.89 | 0.203 | 2.96 | 9.68 | 8.3 | 139.6 | Clear | None |
| 15:10 | 5 | 15 | 200 | 14.05 | 1.06 | 7.89 | 0.204 | 2.37 | 9.63 | 8.3 | 139.6 | Clear | None |
| 15:15 | 5 | 20 | 200 | 14.05 | 1.32 | 7.89 | 0.204 | 2.23 | 9.61 | 8.3 | 139.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_4 | | | **Date** | 4/1/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 45.9 degrees F and Mostly Clear. The wind is blowing undefined at 0.0 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 14.04 | **Total Depth (ft-bmp)** | 23 | **Water Column (ft)** | 8.96 | **Gallons in Well** | |
| **Purge Start** | 15:35 | **Pump Intake (ft-bmp)** | 22.5 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:10 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_4_04012024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:00 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:40 | 0 | 0 | 200 | 14.04 | 0.26 | 7.89 | 0.213 | 5.59 | 9.33 | 8.8 | 143.9 | Clear | None |
| 15:45 | 5 | 5 | 200 | 14.04 | 0.53 | 7.9 | 0.212 | 2.93 | 10.09 | 8.7 | 142.4 | Clear | None |
| 15:50 | 5 | 10 | 200 | 14.04 | 0.79 | 7.91 | 0.212 | 2.41 | 10.07 | 8.7 | 141.4 | Clear | None |
| 15:55 | 5 | 15 | 200 | 14.04 | 1.06 | 7.91 | 0.212 | 2.11 | 10.08 | 8.7 | 140.9 | Clear | None |
| 16:00 | 5 | 20 | 200 | 14.04 | 1.32 | 7.91 | 0.212 | 1.93 | 10.22 | 8.7 | 140.1 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_5 | | | **Date** | 4/1/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 45.5 degrees F and Partly Cloudy. The wind is blowing E at 5.8 mph. | | | |
| **Measuring Pt. Description** | Top of Inner Casing | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | PVC |
| **Static Water Level (ft-bmp)** | 14.04 | **Total Depth (ft-bmp)** | 26.5 | **Water Column (ft)** | 12.46 | **Gallons in Well** | |
| **Purge Start** | 16:15 | **Pump Intake (ft-bmp)** | 26 | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:45 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_4_04012024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:40 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:20 | 0 | 0 | 200 | 14.04 | 0.26 | 7.87 | 0.208 | 3.48 | 10.45 | 9 | 136.7 | Clear | None |
| 16:25 | 5 | 5 | 200 | 14.04 | 0.53 | 7.9 | 0.208 | 3.14 | 10.65 | 9 | 133.6 | Clear | None |
| 16:30 | 5 | 10 | 200 | 14.04 | 0.79 | 7.91 | 0.208 | 2.81 | 10.73 | 9 | 132.7 | Clear | None |
| 16:35 | 5 | 15 | 200 | 14.04 | 1.06 | 7.91 | 0.208 | 2.44 | 10.7 | 9 | 132.8 | Clear | None |
| 16:40 | 5 | 20 | 200 | 14.04 | 1.32 | 7.91 | 0.208 | 2.14 | 10.65 | 9 | 132.6 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-B1 | | | **Date** | 4/2/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 40.5 degrees F and Cloudy. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 14:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:30 | **Volumes Purged** | | **Sample ID** | VRTB-D-B1_04022024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:20 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:30 | 0 | 0 | 200 | 0.00 | 0.26 | 12.05 | 1.02 | 2.57 | 0.34 | 6.1 | 53 | Clear | None |
| 14:35 | 5 | 5 | 200 | 0.00 | 0.53 | 12.15 | 0.87 | 2.33 | 0.51 | 6.1 | 44.1 | Clear | None |
| 14:40 | 5 | 10 | 200 | 0.00 | 0.79 | 12.13 | 0.64 | 2.02 | 1.18 | 6 | 29.7 | Clear | None |
| 14:45 | 5 | 15 | 200 | 0.00 | 1.06 | 12.05 | 0.53 | 1.91 | 1.69 | 6 | 24.2 | Clear | None |
| 14:50 | 5 | 20 | 200 | 0.00 | 1.32 | 11.96 | 0.453 | 1.66 | 2.18 | 6 | 18.3 | Clear | None |
| 14:55 | 5 | 25 | 200 | 0.00 | 1.59 | 11.84 | 0.387 | 1.55 | 2.92 | 6.1 | 12 | Clear | None |
| 15:00 | 5 | 30 | 200 | 0.00 | 1.85 | 11.71 | 0.338 | 1.41 | 3.53 | 6.3 | 8 | Clear | None |
| 15:05 | 5 | 35 | 200 | 0.00 | 2.11 | 11.63 | 0.314 | 1.34 | 3.82 | 6.3 | 5.7 | Clear | None |
| 15:10 | 5 | 40 | 200 | 0.00 | 2.38 | 11.56 | 0.291 | 1.21 | 3.89 | 6.3 | 4.1 | Clear | None |
| 15:15 | 5 | 45 | 200 | 0.00 | 2.64 | 11.52 | 0.286 | 1.02 | 3.93 | 6.3 | 3.4 | Clear | None |
| 15:20 | 5 | 50 | 200 | 0.00 | 2.91 | 11.49 | 0.283 | 0.87 | 3.98 | 6.2 | 1.6 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-G4 | | | **Date** | 4/2/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 32.0 degrees F and Light Sleet and Fog/Mist. The wind is blowing E at 20.7 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 17:30 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:15 | **Volumes Purged** | | **Sample ID** | VRTB-D-G4_04022024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:35 | 0 | 0 | 200 | 0.00 | 0.26 | 7.68 | 0.169 | 3.06 | 1.77 | 6.9 | -43.4 | Clear | None |
| 17:40 | 5 | 5 | 200 | 0.00 | 0.53 | 7.76 | 0.164 | 2.62 | 3.03 | 6.9 | -42.3 | Clear | None |
| 17:45 | 5 | 10 | 200 | 0.00 | 0.79 | 7.8 | 0.162 | 2.03 | 4.11 | 7 | -41.1 | Clear | None |
| 17:50 | 5 | 15 | 200 | 0.00 | 1.06 | 7.86 | 0.159 | 1.85 | 5.11 | 7 | -34.2 | Clear | None |
| 17:55 | 5 | 20 | 200 | 0.00 | 1.32 | 7.86 | 0.157 | 1.81 | 5.24 | 6.8 | -31.6 | Clear | None |
| 18:00 | 5 | 25 | 200 | 0.00 | 1.59 | 7.88 | 0.154 | 1.43 | 5.35 | 6.7 | -26.6 | Clear | None |
| 18:05 | 5 | 30 | 200 | 0.00 | 1.85 | 7.88 | 0.154 | 1.33 | 5.42 | 6.7 | -23.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-M5 | | | **Date** | 4/3/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 37.4 degrees F and Cloudy. The wind is blowing S at 10.3 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 12:00 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:40 | **Volumes Purged** | | **Sample ID** | VRTB-D-M5_04032024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:30 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:05 | 0 | 0 | 200 | 0.00 | 0.26 | 7.76 | 0.19 | 2.55 | 1.76 | 7.1 | 82 | Clear | None |
| 12:10 | 5 | 5 | 200 | 0.00 | 0.53 | 7.85 | 0.191 | 2.14 | 1.99 | 7.1 | 75.1 | Clear | None |
| 12:15 | 5 | 10 | 200 | 0.00 | 0.79 | 7.96 | 0.192 | 1.78 | 2.7 | 7.1 | 64.7 | Clear | None |
| 12:20 | 5 | 15 | 200 | 0.00 | 1.06 | 8.01 | 0.191 | 1.64 | 3.46 | 7.3 | 60.2 | Clear | None |
| 12:25 | 5 | 20 | 200 | 0.00 | 1.32 | 8.01 | 0.19 | 1.37 | 3.59 | 7.3 | 60 | Clear | None |
| 12:30 | 5 | 25 | 200 | 0.00 | 1.59 | 8.02 | 0.19 | 1.21 | 3.76 | 7.3 | 59.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-O6 | | | **Date** | 4/3/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 39.2 degrees F and Cloudy. The wind is blowing S/SW at 9.2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 12:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:30 | **Volumes Purged** | | **Sample ID** | VRTB-D-O6_04032024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:20 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:45 | 0 | 0 | 200 | 0.00 | 0.26 | 7.52 | 0.205 | 4.55 | 1.74 | 7.5 | 58.1 | Clear | None |
| 12:50 | 5 | 5 | 200 | 0.00 | 0.53 | 7.57 | 0.202 | 3.58 | 1.58 | 7.7 | 47.3 | Clear | None |
| 12:55 | 5 | 10 | 200 | 0.00 | 0.79 | 7.61 | 0.197 | 2.97 | 1.6 | 7.8 | 23.7 | Clear | None |
| 13:00 | 5 | 15 | 200 | 0.00 | 1.06 | 7.67 | 0.19 | 2.23 | 2.68 | 7.9 | 21.1 | Clear | None |
| 13:05 | 5 | 20 | 200 | 0.00 | 1.32 | 7.71 | 0.188 | 2.02 | 3.38 | 7.9 | 18.1 | Clear | None |
| 13:10 | 5 | 25 | 200 | 0.00 | 1.59 | 7.75 | 0.185 | 1.86 | 4.21 | 8 | 17.7 | Clear | None |
| 13:15 | 5 | 30 | 200 | 0.00 | 1.85 | 7.77 | 0.183 | 1.59 | 4.46 | 8 | 17.6 | Clear | None |
| 13:20 | 5 | 35 | 200 | 0.00 | 2.11 | 7.79 | 0.182 | 1.41 | 4.53 | 8 | 17.7 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-P8 | | | **Date** | 4/3/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 41.5 degrees F and Cloudy. The wind is blowing S/SE at 9.2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 14:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:35 | **Volumes Purged** | | **Sample ID** | VRTB-D-P8_04032024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:25 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:45 | 0 | 0 | 200 | 0.00 | 0.26 | 11.96 | 0.87 | 4.28 | 1.99 | 7.7 | -64.8 | Clear | None |
| 14:50 | 5 | 5 | 200 | 0.00 | 0.53 | 11.96 | 0.62 | 3.28 | 3.02 | 7.9 | -66.7 | Clear | None |
| 14:55 | 5 | 10 | 200 | 0.00 | 0.79 | 11.88 | 0.422 | 2.81 | 4.62 | 8 | -65.3 | Clear | None |
| 15:00 | 5 | 15 | 200 | 0.00 | 1.06 | 11.52 | 0.278 | 2.46 | 5.65 | 8.1 | -47 | Clear | None |
| 15:05 | 5 | 20 | 200 | 0.00 | 1.32 | 11.22 | 0.214 | 2.09 | 6.21 | 8 | -31.2 | Clear | None |
| 15:10 | 5 | 25 | 200 | 0.00 | 1.59 | 11.03 | 0.196 | 1.72 | 6.39 | 8 | -24.9 | Clear | None |
| 15:15 | 5 | 30 | 200 | 0.00 | 1.85 | 10.85 | 0.186 | 1.56 | 6.65 | 8 | -21.3 | Clear | None |
| 15:20 | 5 | 35 | 200 | 0.00 | 2.11 | 10.81 | 0.183 | 1.44 | 6.69 | 8 | -19.5 | Clear | None |
| 15:25 | 5 | 40 | 200 | 0.00 | 2.38 | 10.79 | 0.181 | 1.22 | 6.74 | 8 | -17.7 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-R7 | | | **Date** | 4/3/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 42.6 degrees F and Cloudy. The wind is blowing S at 8.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 13:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:30 | **Volumes Purged** | | **Sample ID** | VRTB-D-R7_04032024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:20 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:45 | 0 | 0 | 200 | 0.00 | 0.26 | 7.61 | 0.211 | 5.49 | 0.17 | 7.8 | -21.4 | Clear | None |
| 13:50 | 5 | 5 | 200 | 0.00 | 0.53 | 7.63 | 0.206 | 2.48 | 0.2 | 7.8 | -25.8 | Clear | None |
| 13:55 | 5 | 10 | 200 | 0.00 | 0.79 | 7.66 | 0.202 | 2.32 | 0.21 | 7.8 | -30.8 | Clear | None |
| 14:00 | 5 | 15 | 200 | 0.00 | 1.06 | 7.67 | 0.2 | 2.1 | 0.24 | 7.8 | -33.3 | Clear | None |
| 14:05 | 5 | 20 | 200 | 0.00 | 1.32 | 7.69 | 0.198 | 1.96 | 0.31 | 7.8 | -36.6 | Clear | None |
| 14:10 | 5 | 25 | 200 | 0.00 | 1.59 | 7.7 | 0.196 | 1.96 | 0.37 | 7.8 | -38.3 | Clear | None |
| 14:15 | 5 | 30 | 200 | 0.00 | 1.85 | 7.71 | 0.194 | 1.36 | 0.39 | 7.8 | -39.9 | Clear | None |
| 14:20 | 5 | 35 | 200 | 0.00 | 2.11 | 7.72 | 0.194 | 1.21 | 0.4 | 7.8 | -42 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-S2 | | | **Date** | 4/2/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 37.4 degrees F and Light Rain. The wind is blowing E at 16.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 15:30 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:20 | **Volumes Purged** | | **Sample ID** | VRTB-D-S2_04022024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:10 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:35 | 0 | 0 | 200 | 0.00 | 0.26 | 8.98 | 0.233 | 4.47 | 10.89 | 5.9 | -100.8 | Clear | None |
| 15:40 | 5 | 5 | 200 | 0.00 | 0.53 | 8.38 | 0.234 | 2.39 | 10.53 | 5.8 | -165.1 | Clear | None |
| 15:45 | 5 | 10 | 200 | 0.00 | 0.79 | 8.21 | 0.226 | 2.09 | 10.36 | 5.6 | -164.9 | Clear | None |
| 15:50 | 5 | 15 | 200 | 0.00 | 1.06 | 8.12 | 0.222 | 1.86 | 10.08 | 5.7 | -160.8 | Clear | None |
| 15:55 | 5 | 20 | 200 | 0.00 | 1.32 | 8.09 | 0.22 | 1.45 | 9.94 | 5.6 | -157.3 | Clear | None |
| 16:00 | 5 | 25 | 200 | 0.00 | 1.59 | 8.06 | 0.216 | 1.49 | 9.67 | 5.4 | -149.5 | Clear | None |
| 16:05 | 5 | 30 | 200 | 0.00 | 1.85 | 8.05 | 0.215 | 1.31 | 9.57 | 5.5 | -146.5 | Clear | None |
| 16:10 | 5 | 35 | 200 | 0.00 | 2.11 | 8.05 | 0.214 | 1.22 | 9.51 | 5.5 | -143.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-Y3 | | | **Date** | 4/2/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 33.8 degrees F and Snow and Fog. The wind is blowing E at 17.3 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 16:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:25 | **Volumes Purged** | | **Sample ID** | VRTB-D-Y3_04022024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:15 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:50 | 0 | 0 | 200 | 0.00 | 0.26 | 8.03 | 0.194 | 4.49 | 3.78 | 7.3 | -99.9 | Clear | None |
| 16:55 | 5 | 5 | 200 | 0.00 | 0.53 | 8.02 | 0.191 | 2.79 | 3.99 | 7.4 | -97.3 | Clear | None |
| 17:00 | 5 | 10 | 200 | 0.00 | 0.79 | 8.01 | 0.188 | 2.1 | 4.59 | 7.4 | -94.4 | Clear | None |
| 17:05 | 5 | 15 | 200 | 0.00 | 1.06 | 8.02 | 0.186 | 1.89 | 4.99 | 7.4 | -92.3 | Clear | None |
| 17:10 | 5 | 20 | 200 | 0.00 | 1.32 | 8.03 | 0.183 | 1.74 | 5.01 | 7.4 | -90.6 | Clear | None |
| 17:15 | 5 | 25 | 200 | 0.00 | 1.59 | 8.03 | 0.181 | 1.5 | 5.05 | 7.4 | -88.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-B1 | | | **Date** | 4/4/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 40.8 degrees F and Cloudy. The wind is blowing S/SE at 10.3 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 09:00 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:45 | **Volumes Purged** | | **Sample ID** | VRTB-L-B1_04042024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:35 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:05 | 0 | 0 | 200 | 0.00 | 0.26 | 8.54 | 0.224 | 7.48 | 0.5 | 7.6 | 38.3 | Clear | None |
| 09:10 | 5 | 5 | 200 | 0.00 | 0.53 | 8.62 | 0.219 | 3.59 | 0.49 | 7.5 | 24.3 | Clear | None |
| 09:15 | 5 | 10 | 200 | 0.00 | 0.79 | 8.69 | 0.217 | 2.51 | 0.34 | 7.4 | 9.2 | Clear | None |
| 09:20 | 5 | 15 | 200 | 0.00 | 1.06 | 8.74 | 0.214 | 2.23 | 0.44 | 7.4 | -9.7 | Clear | None |
| 09:25 | 5 | 20 | 200 | 0.00 | 1.32 | 8.71 | 0.213 | 2.11 | 0.49 | 7.4 | -23.9 | Clear | None |
| 09:30 | 5 | 25 | 200 | 0.00 | 1.59 | 8.73 | 0.213 | 1.79 | 0.49 | 7.4 | -26.8 | Clear | None |
| 09:35 | 5 | 30 | 200 | 0.00 | 1.85 | 8.75 | 0.213 | 1.63 | 0.52 | 7.5 | -29.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-BB8 | | | **Date** | 4/1/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 44.1 degrees F and Mostly Cloudy. The wind is blowing E at 9.2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 19:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 20:15 | **Volumes Purged** | | **Sample ID** | VRTB-L-BB8_04012024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 20:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 19:45 | 0 | 0 | 200 | 0.00 | 0.26 | 7.78 | 0.232 | 3.81 | 2.53 | 7.4 | -16.5 | Clear | None |
| 19:50 | 5 | 5 | 200 | 0.00 | 0.53 | 7.78 | 0.233 | 2.49 | 2.51 | 7.4 | -10.8 | Clear | None |
| 19:55 | 5 | 10 | 200 | 0.00 | 0.79 | 7.78 | 0.233 | 2.27 | 2.39 | 7.5 | -5.4 | Clear | None |
| 20:00 | 5 | 15 | 200 | 0.00 | 1.06 | 7.78 | 0.237 | 1.94 | 2.35 | 7.5 | -2.7 | Clear | None |
| 20:05 | 5 | 20 | 200 | 0.00 | 1.32 | 7.78 | 0.233 | 1.61 | 2.31 | 7.4 | -0.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-G4 | | | **Date** | 4/4/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 40.8 degrees F and Cloudy. The wind is blowing S/SE at 10.3 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 11:20 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:55 | **Volumes Purged** | | **Sample ID** | VRTB-L-G4_04042024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:45 | **Gallons Purged** | | **Replicate/ Code No.** | DUP-02_04042024 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:25 | 0 | 0 | 200 | 0.00 | 0.26 | 7.85 | 0.198 | 1.94 | 2.09 | 7.3 | 56.2 | Clear | None |
| 11:30 | 5 | 5 | 200 | 0.00 | 0.53 | 7.88 | 0.198 | 1.61 | 2.06 | 7.2 | 53.3 | Clear | None |
| 11:35 | 5 | 10 | 200 | 0.00 | 0.79 | 7.89 | 0.196 | 1.32 | 2.02 | 6.7 | 49 | Clear | None |
| 11:40 | 5 | 15 | 200 | 0.00 | 1.06 | 7.89 | 0.197 | 1.13 | 2.02 | 6.9 | 45.2 | Clear | None |
| 11:45 | 5 | 20 | 200 | 0.00 | 1.32 | 7.9 | 0.197 | 0.92 | 2.04 | 6.9 | 42.4 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-M5 | | | **Date** | 4/1/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 45.5 degrees F and Partly Cloudy. The wind is blowing E at 5.8 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 17:10 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:50 | **Volumes Purged** | | **Sample ID** | VRTB-L-M5_04012024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:40 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:15 | 0 | 0 | 200 | 0.00 | 0.26 | 7.75 | 0.215 | 2.19 | 3.16 | 7.4 | 116.2 | Clear | None |
| 17:20 | 5 | 5 | 200 | 0.00 | 0.53 | 7.78 | 0.215 | 1.91 | 3.04 | 7.4 | 114.9 | Clear | None |
| 17:25 | 5 | 10 | 200 | 0.00 | 0.79 | 7.81 | 0.213 | 1.63 | 3.48 | 7.3 | 102.4 | Clear | None |
| 17:30 | 5 | 15 | 200 | 0.00 | 1.06 | 7.82 | 0.213 | 1.46 | 3.52 | 7.3 | 97.5 | Clear | None |
| 17:35 | 5 | 20 | 200 | 0.00 | 1.32 | 7.83 | 0.212 | 1.35 | 3.57 | 7.3 | 93.1 | Clear | None |
| 17:40 | 5 | 25 | 200 | 0.00 | 1.59 | 7.83 | 0.212 | 1.15 | 3.62 | 7.3 | 87.5 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-O6 | | | **Date** | 4/1/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 45.5 degrees F and Partly Cloudy. The wind is blowing E/NE at 11.4 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 17:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:35 | **Volumes Purged** | | **Sample ID** | VRTB-L-O6_04012024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:25 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:00 | 0 | 0 | 200 | 0.00 | 0.26 | 7.85 | 0.216 | 4.59 | 0.47 | 7.1 | 81 | Clear | None |
| 18:05 | 5 | 5 | 200 | 0.00 | 0.53 | 7.81 | 0.215 | 3.11 | 1.98 | 7.2 | 67.5 | Clear | None |
| 18:10 | 5 | 10 | 200 | 0.00 | 0.79 | 7.76 | 0.215 | 2.58 | 3.03 | 7.2 | 57.1 | Clear | None |
| 18:15 | 5 | 15 | 200 | 0.00 | 1.06 | 7.76 | 0.215 | 2.11 | 3.16 | 7.2 | 57.2 | Clear | None |
| 18:20 | 5 | 20 | 200 | 0.00 | 1.32 | 7.76 | 0.215 | 1.89 | 3.01 | 7.2 | 57.7 | Clear | None |
| 18:25 | 5 | 25 | 200 | 0.00 | 1.59 | 7.76 | 0.215 | 1.51 | 2.98 | 7.2 | 57.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-P7 | | | **Date** | 4/1/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 45.0 degrees F and Mostly Cloudy. The wind is blowing E at 9.2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 18:50 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 19:35 | **Volumes Purged** | | **Sample ID** | VRTB-L-P7_04012024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 19:25 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:55 | 0 | 0 | 200 | 0.00 | 0.26 | 7.78 | 0.222 | 8.69 | 0.43 | 7.3 | 22.5 | Clear | None |
| 19:00 | 5 | 5 | 200 | 0.00 | 0.53 | 7.81 | 0.209 | 3.49 | 0.2 | 7.4 | 6.1 | Clear | None |
| 19:05 | 5 | 10 | 200 | 0.00 | 0.79 | 7.9 | 0.205 | 2.91 | 0.14 | 7.4 | -1.8 | Clear | None |
| 19:10 | 5 | 15 | 200 | 0.00 | 1.06 | 8.03 | 0.203 | 2.32 | 0.27 | 7.4 | -11.9 | Clear | None |
| 19:15 | 5 | 20 | 200 | 0.00 | 1.32 | 8.06 | 0.202 | 2.11 | 0.3 | 7.4 | -14.6 | Clear | None |
| 19:20 | 5 | 25 | 200 | 0.00 | 1.59 | 8.08 | 0.202 | 1.74 | 0.31 | 7.4 | -17.1 | Clear | None |
| 19:25 | 5 | 30 | 200 | 0.00 | 1.85 | 8.11 | 0.201 | 1.43 | 0.32 | 7.4 | -21.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-S2 | | | **Date** | 4/4/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 40.8 degrees F and Cloudy. The wind is blowing S/SE at 10.3 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 09:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:40 | **Volumes Purged** | | **Sample ID** | VRTB-L-S2_04042024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:15 | **Gallons Purged** | | **Replicate/ Code No.** | MS/MSD | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:50 | 0 | 0 | 200 | 0.00 | 0.26 | 10.31 | 0.195 | 15.7 | 1.07 | 7.1 | -21.1 | Clear | None |
| 09:55 | 5 | 5 | 200 | 0.00 | 0.53 | 10.03 | 0.187 | 11.2 | 0.75 | 7.2 | -23.9 | Clear | None |
| 10:00 | 5 | 10 | 200 | 0.00 | 0.79 | 9.76 | 0.182 | 4.48 | 0.64 | 7.3 | -24.1 | Clear | None |
| 10:05 | 5 | 15 | 200 | 0.00 | 1.06 | 9.6 | 0.181 | 2.93 | 0.65 | 7.3 | -24.3 | Clear | None |
| 10:10 | 5 | 20 | 200 | 0.00 | 1.32 | 9.55 | 0.18 | 2.14 | 0.63 | 7.3 | -24.4 | Clear | None |
| 10:15 | 5 | 25 | 200 | 0.00 | 1.59 | 9.5 | 0.18 | 2.01 | 0.61 | 7.3 | -24.4 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-Y3 | | | **Date** | 4/4/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 40.8 degrees F and Cloudy. The wind is blowing S/SE at 10.3 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 10:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:15 | **Volumes Purged** | | **Sample ID** | VRTB-L-Y3_04042024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:45 | 0 | 0 | 200 | 0.00 | 0.26 | 7.58 | 0.216 | 8.29 | 1.19 | 6.8 | 29.2 | Clear | None |
| 10:50 | 5 | 5 | 200 | 0.00 | 0.53 | 7.65 | 0.217 | 5.52 | 2.66 | 7 | 25.3 | Clear | None |
| 10:55 | 5 | 10 | 200 | 0.00 | 0.79 | 7.83 | 0.183 | 4.46 | 7.11 | 7.2 | 24.1 | Clear | None |
| 11:00 | 5 | 15 | 200 | 0.00 | 1.06 | 7.83 | 0.183 | 4.04 | 7.35 | 7.3 | 28.8 | Clear | None |
| 11:05 | 5 | 20 | 200 | 0.00 | 1.32 | 7.82 | 0.183 | 3.76 | 7.51 | 7.3 | 32.4 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-B1 | | | **Date** | 4/3/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 41.5 degrees F and Cloudy. The wind is blowing S/SE at 9.2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 15:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:30 | **Volumes Purged** | | **Sample ID** | VRTB-S-B1_04032024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:20 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:45 | 0 | 0 | 200 | 0.00 | 0.26 | 7.78 | 0.243 | 8.66 | 0.59 | 6.6 | 33.4 | Clear | None |
| 15:50 | 5 | 5 | 200 | 0.00 | 0.53 | 7.73 | 0.25 | 6.37 | 0.65 | 6.7 | 28.7 | Clear | None |
| 15:55 | 5 | 10 | 200 | 0.00 | 0.79 | 7.77 | 0.254 | 4.33 | 0.72 | 6.7 | 22.8 | Clear | None |
| 16:00 | 5 | 15 | 200 | 0.00 | 1.06 | 7.78 | 0.255 | 3.48 | 0.95 | 6.7 | 17.4 | Clear | None |
| 16:05 | 5 | 20 | 200 | 0.00 | 1.32 | 7.79 | 0.252 | 2.81 | 1.3 | 6.9 | 8.1 | Clear | None |
| 16:10 | 5 | 25 | 200 | 0.00 | 1.59 | 7.79 | 0.249 | 2.43 | 1.58 | 6.8 | 3.8 | Clear | None |
| 16:15 | 5 | 30 | 200 | 0.00 | 1.85 | 7.79 | 0.245 | 2.11 | 1.63 | 6.9 | 1.1 | Clear | None |
| 16:20 | 5 | 35 | 200 | 0.00 | 2.11 | 7.79 | 0.242 | 1.87 | 1.73 | 6.9 | -1.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-G4 | | | **Date** | 4/3/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 40.8 degrees F and Cloudy. The wind is blowing S/SE at 10.3 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 18:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 19:30 | **Volumes Purged** | | **Sample ID** | VRTB-S-G4_04032024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 19:20 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:50 | 0 | 0 | 200 | 0.00 | 0.26 | 7.86 | 0.222 | 23.3 | 2.15 | 6.8 | -17.7 | Clear | None |
| 18:55 | 5 | 5 | 200 | 0.00 | 0.53 | 7.89 | 0.228 | 12.6 | 2.15 | 6.8 | -18.9 | Clear | None |
| 19:00 | 5 | 10 | 200 | 0.00 | 0.79 | 7.95 | 0.235 | 8.47 | 2.16 | 6.8 | -18.1 | Clear | None |
| 19:05 | 5 | 15 | 200 | 0.00 | 1.06 | 7.99 | 0.237 | 6.97 | 2.2 | 6.8 | -16.2 | Clear | None |
| 19:10 | 5 | 20 | 200 | 0.00 | 1.32 | 8.03 | 0.237 | 4.58 | 2.35 | 6.8 | -13.4 | Clear | None |
| 19:15 | 5 | 25 | 200 | 0.00 | 1.59 | 8.06 | 0.237 | 4.22 | 2.43 | 6.8 | -9.4 | Clear | None |
| 19:20 | 5 | 30 | 200 | 0.00 | 1.85 | 8.08 | 0.236 | 3.9 | 2.48 | 6.7 | -4.1 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-M5 | | | **Date** | 4/2/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 32.0 degrees F and Partly Cloudy. The wind is blowing E at 9.2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 09:30 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:15 | **Volumes Purged** | | **Sample ID** | VRTB-S-M5_04022024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:35 | 0 | 0 | 200 | 0.00 | 0.26 | 7.63 | 0.232 | 3.47 | 2.26 | 5.9 | 67.6 | Clear | None |
| 09:40 | 5 | 5 | 200 | 0.00 | 0.53 | 7.66 | 0.234 | 3.11 | 2.24 | 5.9 | 66.1 | Clear | None |
| 09:45 | 5 | 10 | 200 | 0.00 | 0.79 | 7.69 | 0.237 | 2.8 | 2.24 | 6.4 | 62.6 | Clear | None |
| 09:50 | 5 | 15 | 200 | 0.00 | 1.06 | 7.7 | 0.238 | 2.12 | 2.29 | 6.5 | 61.3 | Clear | None |
| 09:55 | 5 | 20 | 200 | 0.00 | 1.32 | 7.7 | 0.238 | 1.78 | 2.31 | 6.5 | 60.6 | Clear | None |
| 10:00 | 5 | 25 | 200 | 0.00 | 1.59 | 7.72 | 0.237 | 1.61 | 2.4 | 6.6 | 59.2 | Clear | None |
| 10:05 | 5 | 30 | 200 | 0.00 | 1.85 | 7.72 | 0.238 | 1.55 | 2.46 | 6.6 | 59.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-O6 | | | **Date** | 4/2/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 32.0 degrees F and Partly Cloudy. The wind is blowing E at 9.2 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 10:30 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:20 | **Volumes Purged** | | **Sample ID** | VRTB-S-O6_04022024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:10 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:35 | 0 | 0 | 200 | 0.00 | 0.26 | 7.79 | 0.214 | 5.49 | 0.8 | 7.1 | 60.5 | Clear | None |
| 10:40 | 5 | 5 | 200 | 0.00 | 0.53 | 7.82 | 0.2 | 2.69 | 1.73 | 6.8 | 58 | Clear | None |
| 10:45 | 5 | 10 | 200 | 0.00 | 0.79 | 7.84 | 0.199 | 2.13 | 2.9 | 7.3 | 56.7 | Clear | None |
| 10:50 | 5 | 15 | 200 | 0.00 | 1.06 | 7.87 | 0.194 | 2.09 | 3.56 | 7.3 | 57.3 | Clear | None |
| 10:55 | 5 | 20 | 200 | 0.00 | 1.32 | 7.88 | 0.192 | 1.98 | 3.79 | 7.2 | 57.9 | Clear | None |
| 11:00 | 5 | 25 | 200 | 0.00 | 1.59 | 7.88 | 0.192 | 1.84 | 4.08 | 7.2 | 58.9 | Clear | None |
| 11:05 | 5 | 30 | 200 | 0.00 | 1.85 | 7.9 | 0.187 | 1.46 | 4.19 | 7.3 | 60.6 | Clear | None |
| 11:10 | 5 | 35 | 200 | 0.00 | 2.11 | 7.91 | 0.187 | 1.41 | 4.29 | 7.2 | 62.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-P8 | | | **Date** | 4/2/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 40.1 degrees F and Cloudy. The wind is blowing E at 18.4 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 13:05 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:40 | **Volumes Purged** | | **Sample ID** | VRTB-S-P8_04022024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:30 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:10 | 0 | 0 | 200 | 0.00 | 0.26 | 11.82 | 0.44 | 2.81 | 7.3 | 7.7 | 32.5 | Clear | None |
| 13:15 | 5 | 5 | 200 | 0.00 | 0.53 | 11.71 | 0.359 | 2.01 | 7.13 | 7.4 | 27.5 | Clear | None |
| 13:20 | 5 | 10 | 200 | 0.00 | 0.79 | 11.68 | 0.351 | 1.73 | 7.24 | 7.2 | 24 | Clear | None |
| 13:25 | 5 | 15 | 200 | 0.00 | 1.06 | 11.66 | 0.347 | 1.56 | 7.25 | 7.1 | 23 | Clear | None |
| 13:30 | 5 | 20 | 200 | 0.00 | 1.32 | 11.65 | 0.341 | 1.43 | 7.28 | 7 | 22.1 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-R7 | | | **Date** | 4/2/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 40.1 degrees F and Cloudy. The wind is blowing E at 18.4 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 11:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:25 | **Volumes Purged** | | **Sample ID** | VRTB-S-R7_04022024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:15 | **Gallons Purged** | | **Replicate/ Code No.** | DUP-01_04022024 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:40 | 0 | 0 | 200 | 0.00 | 0.26 | 7.75 | 0.88 | 3.08 | 1.35 | 7.1 | 88.9 | Clear | None |
| 11:45 | 5 | 5 | 200 | 0.00 | 0.53 | 7.85 | 0.98 | 2.41 | 0.99 | 7 | 78.8 | Clear | None |
| 11:50 | 5 | 10 | 200 | 0.00 | 0.79 | 7.83 | 0.358 | 1.77 | 0.75 | 7.3 | 72.3 | Clear | None |
| 11:55 | 5 | 15 | 200 | 0.00 | 1.06 | 7.81 | 0.322 | 1.63 | 0.87 | 7.2 | 70.4 | Clear | None |
| 12:00 | 5 | 20 | 200 | 0.00 | 1.32 | 7.79 | 0.304 | 1.49 | 1.01 | 7.2 | 67.5 | Clear | None |
| 12:05 | 5 | 25 | 200 | 0.00 | 1.59 | 7.79 | 0.304 | 1.24 | 0.94 | 7.1 | 67.1 | Clear | None |
| 12:10 | 5 | 30 | 200 | 0.00 | 1.85 | 7.8 | 0.298 | 1.19 | 0.99 | 7.2 | 64.2 | Clear | None |
| 12:15 | 5 | 35 | 200 | 0.00 | 2.11 | 7.8 | 0.296 | 0.92 | 1.02 | 7.3 | 63.9 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

ARCADIS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-S2 | | | **Date** | 4/3/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 40.8 degrees F and Cloudy. The wind is blowing S/SE at 10.3 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 16:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:35 | **Volumes Purged** | | **Sample ID** | VRTB-S-S2_04032024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:25 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:40 | 0 | 0 | 200 | 0.00 | 0.26 | 7.83 | 0.243 | 3.59 | 1.01 | 6.9 | 11.7 | Clear | None |
| 16:45 | 5 | 5 | 200 | 0.00 | 0.53 | 7.88 | 0.245 | 3.03 | 0.5 | 7 | 8.7 | Clear | None |
| 16:50 | 5 | 10 | 200 | 0.00 | 0.79 | 7.9 | 0.246 | 2.82 | 0.29 | 7 | 2.6 | Clear | None |
| 16:55 | 5 | 15 | 200 | 0.00 | 1.06 | 7.86 | 0.244 | 2.38 | 0.85 | 7 | 1.1 | Clear | None |
| 17:00 | 5 | 20 | 200 | 0.00 | 1.32 | 7.84 | 0.243 | 2.16 | 1.24 | 7 | -1.4 | Clear | None |
| 17:05 | 5 | 25 | 200 | 0.00 | 1.59 | 7.79 | 0.239 | 1.66 | 1.99 | 7 | 2.1 | Clear | None |
| 17:10 | 5 | 30 | 200 | 0.00 | 1.85 | 7.78 | 0.238 | 1.62 | 2.23 | 7 | 5.2 | Clear | None |
| 17:15 | 5 | 35 | 200 | 0.00 | 2.11 | 7.78 | 0.237 | 1.73 | 2.41 | 7 | 7.2 | Clear | None |
| 17:20 | 5 | 40 | 200 | 0.00 | 2.38 | 7.77 | 0.236 | 1.53 | 2.57 | 7 | 10 | Clear | None |
| 17:25 | 5 | 45 | 200 | 0.00 | 2.64 | 7.77 | 0.235 | 1.29 | 2.66 | 7 | 13.7 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-Y3 | | | **Date** | 4/3/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 40.8 degrees F and Cloudy. The wind is blowing S/SE at 10.3 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 17:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:40 | **Volumes Purged** | | **Sample ID** | VRTB-S-Y3_04032024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:30 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:50 | 0 | 0 | 200 | 0.00 | 0.26 | 7.95 | 0.386 | 4.4 | 0.36 | 7 | 34.6 | Clear | None |
| 17:55 | 5 | 5 | 200 | 0.00 | 0.53 | 8.21 | 0.393 | 3.75 | 0.18 | 7 | 16.1 | Clear | None |
| 18:00 | 5 | 10 | 200 | 0.00 | 0.79 | 8.26 | 0.376 | 3.14 | 0.33 | 7 | 0.5 | Clear | None |
| 18:05 | 5 | 15 | 200 | 0.00 | 1.06 | 8.23 | 0.357 | 2.16 | 0.33 | 7.1 | -14.6 | Clear | None |
| 18:10 | 5 | 20 | 200 | 0.00 | 1.32 | 8.16 | 0.326 | 1.91 | 1.17 | 7 | -29 | Clear | None |
| 18:15 | 5 | 25 | 200 | 0.00 | 1.59 | 8.14 | 0.319 | 1.68 | 1.28 | 7 | -33.7 | Clear | None |
| 18:20 | 5 | 30 | 200 | 0.00 | 1.85 | 8.12 | 0.313 | 1.6 | 1.34 | 7.1 | -37.2 | Clear | None |
| 18:25 | 5 | 35 | 200 | 0.00 | 2.11 | 8.11 | 0.308 | 1.43 | 1.38 | 7.1 | -39.6 | Clear | None |
| 18:30 | 5 | 40 | 200 | 0.00 | 2.38 | 8.11 | 0.306 | 1.24 | 1.44 | 7.1 | -40.6 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Logs

# Performance Monitoring Event #8

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_1 | | | **Date** | 7/18/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 55.0 degrees F and Clear. The wind is blowing undefined at 0.0 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 13.51 | **Total Depth (ft-bmp)** | 15 | **Water Column (ft)** | 1.49 | **Gallons in Well** | |
| **Purge Start** | 08:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 09:20 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_1_07182024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 09:15 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 08:50 | 0 | 0 | 200 | 13.51 | 0.26 | 7.97 | 0.215 | 5.67 | 10.47 | 12.3 | 105.2 | Clear | None |
| 08:55 | 5 | 5 | 200 | 13.51 | 0.53 | 7.96 | 0.215 | 3.1 | 10.4 | 12.1 | 106.6 | Clear | None |
| 09:00 | 5 | 10 | 200 | 13.51 | 0.79 | 7.93 | 0.216 | 2.96 | 11.48 | 12.1 | 108.4 | Clear | None |
| 09:05 | 5 | 15 | 200 | 13.51 | 1.06 | 7.94 | 0.217 | 2.44 | 10.25 | 12.2 | 106.7 | Clear | None |
| 09:10 | 5 | 20 | 200 | 13.51 | 1.32 | 7.94 | 0.217 | 2.03 | 10.27 | 12.4 | 105.5 | Clear | None |
| 09:15 | 5 | 25 | 200 | 13.51 | 1.59 | 7.94 | 0.217 | 1.91 | 10.29 | 12.4 | 104.7 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_2 | | | **Date** | 7/18/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 61.0 degrees F and Clear. The wind is blowing N/NW at 4.6 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 13.50 | **Total Depth (ft-bmp)** | 17 | **Water Column (ft)** | 3.50 | **Gallons in Well** | |
| **Purge Start** | 09:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:10 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_2_07182024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:45 | 0 | 0 | 200 | 13.50 | 0.26 | 7.45 | 0.344 | 1.69 | 0.61 | 12.3 | 96 | Clear | None |
| 09:50 | 5 | 5 | 200 | 13.50 | 0.53 | 7.45 | 0.344 | 1.43 | 0.52 | 12.2 | 92.2 | Clear | None |
| 09:55 | 5 | 10 | 200 | 13.50 | 0.79 | 7.45 | 0.343 | 1.34 | 0.51 | 12.2 | 83.5 | Clear | None |
| 10:00 | 5 | 15 | 200 | 13.50 | 1.06 | 7.44 | 0.341 | 1.27 | 0.47 | 12.1 | 77.7 | Clear | None |
| 10:05 | 5 | 20 | 200 | 13.50 | 1.32 | 7.44 | 0.341 | 1.22 | 0.47 | 12.1 | 74.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_3 | | | **Date** | 7/18/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 61.0 degrees F and Clear. The wind is blowing N/NW at 4.6 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 13.48 | **Total Depth (ft-bmp)** | 19.5 | **Water Column (ft)** | 6.02 | **Gallons in Well** | |
| **Purge Start** | 10:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:45 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_3_07182024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:40 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:20 | 0 | 0 | 200 | 13.48 | 0.26 | 7.67 | 0.4 | 2.06 | 8.88 | 12.2 | 94.6 | Clear | None |
| 10:25 | 5 | 5 | 200 | 13.48 | 0.53 | 7.66 | 0.401 | 1.88 | 9.17 | 12.2 | 97.1 | Clear | None |
| 10:30 | 5 | 10 | 200 | 13.48 | 0.79 | 7.66 | 0.4 | 1.74 | 9.44 | 11.9 | 99.6 | Clear | None |
| 10:35 | 5 | 15 | 200 | 13.48 | 1.06 | 7.66 | 0.402 | 1.43 | 9.52 | 12.1 | 99.8 | Clear | None |
| 10:40 | 5 | 20 | 200 | 13.48 | 1.32 | 7.66 | 0.402 | 1.22 | 9.57 | 12.2 | 100.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_4 | | | **Date** | 7/18/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 64.6 degrees F and Mostly Clear. The wind is blowing N/NW at 5.8 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 13.48 | **Total Depth (ft-bmp)** | 23 | **Water Column (ft)** | 9.52 | **Gallons in Well** | |
| **Purge Start** | 10:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:25 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_4_07182024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:20 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:00 | 0 | 0 | 200 | 13.48 | 0.26 | 7.71 | 0.359 | 8.17 | 9.48 | 11.6 | 103.7 | Clear | None |
| 11:05 | 5 | 5 | 200 | 13.48 | 0.53 | 7.69 | 0.357 | 4.49 | 9.65 | 11.4 | 107 | Clear | None |
| 11:10 | 5 | 10 | 200 | 13.48 | 0.79 | 7.68 | 0.357 | 3.68 | 9.69 | 11.3 | 107.7 | Clear | None |
| 11:15 | 5 | 15 | 200 | 13.48 | 1.06 | 7.66 | 0.356 | 3.14 | 9.83 | 11.3 | 109.7 | Clear | None |
| 11:20 | 5 | 20 | 200 | 13.48 | 1.32 | 7.66 | 0.357 | 3.04 | 9.89 | 11.3 | 108 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | CMT-VRTB-01_5 | | | **Date** | 7/18/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 64.6 degrees F and Mostly Clear. The wind is blowing N/NW at 5.8 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 13.48 | **Total Depth (ft-bmp)** | 26.5 | **Water Column (ft)** | 13.02 | **Gallons in Well** | |
| **Purge Start** | 11:30 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:00 | **Volumes Purged** | | **Sample ID** | CMT-VRTB-01_5_07182024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:55 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:35 | 0 | 0 | 200 | 13.48 | 0.26 | 7.8 | 0.284 | 2.47 | 9.49 | 11.4 | 104.8 | Clear | None |
| 11:40 | 5 | 5 | 200 | 13.48 | 0.53 | 7.79 | 0.283 | 2.12 | 9.73 | 11.3 | 107 | Clear | None |
| 11:45 | 5 | 10 | 200 | 13.48 | 0.79 | 7.77 | 0.283 | 1.98 | 10 | 11.8 | 105.6 | Clear | None |
| 11:50 | 5 | 15 | 200 | 13.48 | 1.06 | 7.77 | 0.283 | 1.67 | 10.09 | 11.8 | 105.2 | Clear | None |
| 11:55 | 5 | 20 | 200 | 13.48 | 1.32 | 7.77 | 0.283 | 1.55 | 10.12 | 11.8 | 104.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-B1 | | | **Date** | 7/16/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 69.8 degrees F and Fog/Mist. The wind is blowing NW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 10:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:10 | **Volumes Purged** | | **Sample ID** | VRTB-D-B1_07162024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:20 | 0 | 0 | 200 | 0.00 | 0.26 | 11.7 | 1.26 | 6.55 | 0.77 | 16.8 | -66.8 | Clear | None |
| 10:25 | 5 | 5 | 200 | 0.00 | 0.53 | 11.68 | 1.33 | 5.42 | 1.12 | 16.6 | -64.9 | Clear | None |
| 10:30 | 5 | 10 | 200 | 0.00 | 0.79 | 11.66 | 1.46 | 4.48 | 1.48 | 16.4 | -62.2 | Clear | None |
| 10:35 | 5 | 15 | 200 | 0.00 | 1.06 | 11.6 | 0.787 | 4.15 | 2.03 | 16.3 | -54.4 | Clear | None |
| 10:40 | 5 | 20 | 200 | 0.00 | 1.32 | 11.44 | 0.643 | 3.91 | 2.56 | 16.2 | -42.1 | Clear | None |
| 10:45 | 5 | 25 | 200 | 0.00 | 1.59 | 11.35 | 0.55 | 3.46 | 3.41 | 16.3 | -33.6 | Clear | None |
| 10:50 | 5 | 30 | 200 | 0.00 | 1.85 | 11.25 | 0.502 | 3.22 | 3.79 | 16.4 | -27.6 | Clear | None |
| 10:55 | 5 | 35 | 200 | 0.00 | 2.11 | 11.21 | 0.479 | 2.89 | 3.94 | 16.4 | -24.5 | Clear | None |
| 11:00 | 5 | 40 | 200 | 0.00 | 2.38 | 11.18 | 0.471 | 2.8 | 3.99 | 16.4 | -22.5 | Clear | None |
| 11:05 | 5 | 45 | 200 | 0.00 | 2.64 | 11.15 | 0.466 | 2.03 | 4.04 | 16.4 | -20.1 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-G4 | | | **Date** | 7/16/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 73.4 degrees F and Cloudy. The wind is blowing W/NW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 13:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:00 | **Volumes Purged** | | **Sample ID** | VRTB-D-G4_07162024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:55 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:30 | 0 | 0 | 200 | 0.00 | 0.26 | 7.57 | 0.254 | 3.41 | 3.66 | 15.9 | -17.4 | Clear | None |
| 13:35 | 5 | 5 | 200 | 0.00 | 0.53 | 7.61 | 0.25 | 2.69 | 4.61 | 16.3 | -9.5 | Clear | None |
| 13:40 | 5 | 10 | 200 | 0.00 | 0.79 | 7.63 | 0.249 | 2.29 | 4.96 | 16.3 | -3.6 | Clear | None |
| 13:45 | 5 | 15 | 200 | 0.00 | 1.06 | 7.66 | 0.247 | 2.07 | 5.23 | 15.8 | 2.5 | Clear | None |
| 13:50 | 5 | 20 | 200 | 0.00 | 1.32 | 7.67 | 0.245 | 1.77 | 5.45 | 15.9 | 9 | Clear | None |
| 13:55 | 5 | 25 | 200 | 0.00 | 1.59 | 7.69 | 0.245 | 1.71 | 5.51 | 16.2 | 12.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-M5 | | | **Date** | 7/15/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 82.4 degrees F and Mostly Clear. The wind is blowing NW at 8.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 12:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:30 | **Volumes Purged** | | **Sample ID** | VRTB-D-M5_07152024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:25 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:00 | 0 | 0 | 200 | 0.00 | 0.26 | 7.86 | 0.28 | 8.46 | 3.25 | 17.1 | -5.7 | Clear | None |
| 13:05 | 5 | 5 | 200 | 0.00 | 0.53 | 7.87 | 0.277 | 6.87 | 3.94 | 17 | -3.6 | Clear | None |
| 13:10 | 5 | 10 | 200 | 0.00 | 0.79 | 7.88 | 0.275 | 6.69 | 4.21 | 16.7 | 2 | Clear | None |
| 13:15 | 5 | 15 | 200 | 0.00 | 1.06 | 7.89 | 0.274 | 6.12 | 4.57 | 16.6 | 14.5 | Clear | None |
| 13:20 | 5 | 20 | 200 | 0.00 | 1.32 | 7.91 | 0.273 | 5.94 | 4.71 | 16.6 | 18.4 | Clear | None |
| 13:25 | 5 | 25 | 200 | 0.00 | 1.59 | 7.93 | 0.272 | 5.71 | 4.83 | 16.7 | 19.5 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-O6 | | | **Date** | 7/15/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 84.6 degrees F and Mostly Clear. The wind is blowing NW at 8.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 13:50 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:45 | **Volumes Purged** | | **Sample ID** | VRTB-D-O6_07152024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:40 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 13:55 | 0 | 0 | 200 | 0.00 | 0.26 | 7.37 | 0.285 | 15.57 | 2.11 | 17.3 | 49.5 | Clear | None |
| 14:00 | 5 | 5 | 200 | 0.00 | 0.53 | 7.39 | 0.294 | 7.74 | 1.15 | 17 | -81.6 | Clear | None |
| 14:05 | 5 | 10 | 200 | 0.00 | 0.79 | 7.44 | 0.288 | 6.49 | 2.29 | 17 | -76.6 | Clear | None |
| 14:10 | 5 | 15 | 200 | 0.00 | 1.06 | 7.49 | 0.284 | 6.11 | 3.24 | 16.9 | -67.7 | Clear | None |
| 14:15 | 5 | 20 | 200 | 0.00 | 1.32 | 7.52 | 0.28 | 5.82 | 3.88 | 17.2 | -59.3 | Clear | None |
| 14:20 | 5 | 25 | 200 | 0.00 | 1.59 | 7.55 | 0.279 | 5.14 | 4.28 | 16.5 | -55.2 | Clear | None |
| 14:25 | 5 | 30 | 200 | 0.00 | 1.85 | 7.56 | 0.278 | 4.84 | 4.64 | 16.8 | -42.1 | Clear | None |
| 14:30 | 5 | 35 | 200 | 0.00 | 2.11 | 7.56 | 0.277 | 4.71 | 4.73 | 17 | -39.8 | Clear | None |
| 14:35 | 5 | 40 | 200 | 0.00 | 2.38 | 7.57 | 0.275 | 4.14 | 5.05 | 16.9 | -31.4 | Clear | None |
| 14:40 | 5 | 45 | 200 | 0.00 | 2.64 | 7.58 | 0.273 | 3.95 | 5.11 | 16.9 | -29.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-P8 | | | **Date** | 7/15/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 86.2 degrees F and Mostly Clear. The wind is blowing W/NW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 15:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:30 | **Volumes Purged** | | **Sample ID** | VRTB-D-P8_07152024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:25 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:50 | 0 | 0 | 200 | 0.00 | 0.26 | 11.23 | 1.071 | 2.51 | 2.85 | 15.4 | -111 | Clear | None |
| 15:55 | 5 | 5 | 200 | 0.00 | 0.53 | 11.47 | 1.079 | 2.39 | 2.53 | 16.3 | -101.7 | Clear | None |
| 16:00 | 5 | 10 | 200 | 0.00 | 0.79 | 11.47 | 0.783 | 2.22 | 2.91 | 15.9 | -85.4 | Clear | None |
| 16:05 | 5 | 15 | 200 | 0.00 | 1.06 | 11.13 | 0.43 | 2.01 | 5.79 | 16.4 | -49.4 | Clear | None |
| 16:10 | 5 | 20 | 200 | 0.00 | 1.32 | 11.07 | 0.391 | 1.74 | 6.19 | 15.9 | -40.7 | Clear | None |
| 16:15 | 5 | 25 | 200 | 0.00 | 1.59 | 10.91 | 0.329 | 1.66 | 6.5 | 16.1 | -31.3 | Clear | None |
| 16:20 | 5 | 30 | 200 | 0.00 | 1.85 | 10.88 | 0.326 | 1.53 | 6.59 | 16.1 | -27.3 | Clear | None |
| 16:25 | 5 | 35 | 200 | 0.00 | 2.11 | 10.82 | 0.321 | 1.25 | 6.64 | 16.2 | -24.9 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-R7 | | | **Date** | 7/15/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 86.2 degrees F and Mostly Clear. The wind is blowing W/NW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 14:55 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:40 | **Volumes Purged** | | **Sample ID** | VRTB-D-R7_07152024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:35 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:00 | 0 | 0 | 200 | 0.00 | 0.26 | 7.45 | 0.297 | 2.2 | 1.3 | 15.7 | -88.3 | Clear | None |
| 15:05 | 5 | 5 | 200 | 0.00 | 0.53 | 7.43 | 0.297 | 1.97 | 0.19 | 14.9 | -134.9 | Clear | None |
| 15:10 | 5 | 10 | 200 | 0.00 | 0.79 | 7.42 | 0.294 | 1.82 | 0.2 | 17 | -140.9 | Clear | None |
| 15:15 | 5 | 15 | 200 | 0.00 | 1.06 | 7.44 | 0.29 | 1.61 | 0.22 | 16.9 | -145.1 | Clear | None |
| 15:20 | 5 | 20 | 200 | 0.00 | 1.32 | 7.45 | 0.289 | 1.53 | 0.27 | 17 | -144.8 | Clear | None |
| 15:25 | 5 | 25 | 200 | 0.00 | 1.59 | 7.47 | 0.288 | 1.39 | 0.31 | 16.9 | -142.9 | Clear | None |
| 15:30 | 5 | 30 | 200 | 0.00 | 1.85 | 7.47 | 0.287 | 1.23 | 0.31 | 16.8 | -142.6 | Clear | None |
| 15:35 | 5 | 35 | 200 | 0.00 | 2.11 | 7.48 | 0.284 | 1.09 | 0.32 | 16.8 | -139.1 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-S2 | | | **Date** | 7/16/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 71.2 degrees F and Cloudy. The wind is blowing W/NW at 8.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 11:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:55 | **Volumes Purged** | | **Sample ID** | VRTB-D-S2_07162024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:50 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:20 | 0 | 0 | 200 | 0.00 | 0.26 | 7.57 | 0.356 | 2.89 | 0.99 | 16.4 | -204.5 | Clear | None |
| 11:25 | 5 | 5 | 200 | 0.00 | 0.53 | 7.47 | 0.344 | 2.43 | 0.43 | 16.3 | -190.4 | Clear | None |
| 11:30 | 5 | 10 | 200 | 0.00 | 0.79 | 7.46 | 0.339 | 2.21 | 0.31 | 16.1 | -181.3 | Clear | None |
| 11:35 | 5 | 15 | 200 | 0.00 | 1.06 | 7.45 | 0.33 | 1.91 | 0.25 | 15.9 | -177.1 | Clear | None |
| 11:40 | 5 | 20 | 200 | 0.00 | 1.32 | 7.44 | 0.323 | 1.63 | 0.18 | 15.7 | -171.2 | Clear | None |
| 11:45 | 5 | 25 | 200 | 0.00 | 1.59 | 7.44 | 0.318 | 1.25 | 0.17 | 15.8 | -169.3 | Clear | None |
| 11:50 | 5 | 30 | 200 | 0.00 | 1.85 | 7.44 | 0.317 | 1.21 | 0.17 | 15.9 | -168.9 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-D-Y3 | | | **Date** | 7/16/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 73.4 degrees F and Cloudy. The wind is blowing W/NW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 12:05 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:00 | **Volumes Purged** | | **Sample ID** | VRTB-D-Y3_07162024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:55 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:10 | 0 | 0 | 200 | 0.00 | 0.26 | 7.65 | 0.295 | 10.27 | 0.69 | 16.1 | -120.7 | Clear | None |
| 12:15 | 5 | 5 | 200 | 0.00 | 0.53 | 7.92 | 0.298 | 9.22 | 0.27 | 16 | -156.5 | Clear | None |
| 12:20 | 5 | 10 | 200 | 0.00 | 0.79 | 7.91 | 0.292 | 8.87 | 0.59 | 16 | -157.8 | Clear | None |
| 12:25 | 5 | 15 | 200 | 0.00 | 1.06 | 7.89 | 0.287 | 8.12 | 0.88 | 15.7 | -149.4 | Clear | None |
| 12:30 | 5 | 20 | 200 | 0.00 | 1.32 | 7.87 | 0.283 | 6.55 | 1.24 | 15.6 | -133.5 | Clear | None |
| 12:35 | 5 | 25 | 200 | 0.00 | 1.59 | 7.86 | 0.279 | 5.93 | 1.54 | 15.9 | -126.3 | Clear | None |
| 12:40 | 5 | 30 | 200 | 0.00 | 1.85 | 7.85 | 0.277 | 5.48 | 1.72 | 15.7 | -118.6 | Clear | None |
| 12:45 | 5 | 35 | 200 | 0.00 | 2.11 | 7.85 | 0.273 | 5.11 | 1.87 | 15.8 | -111.7 | Clear | None |
| 12:50 | 5 | 40 | 200 | 0.00 | 2.38 | 7.85 | 0.272 | 4.77 | 1.98 | 15.9 | -108.5 | Clear | None |
| 12:55 | 5 | 45 | 200 | 0.00 | 2.64 | 7.85 | 0.271 | 4.41 | 2 | 16 | -107.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-B1 | | | **Date** | 7/17/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 68.4 degrees F and Clear. The wind is blowing undefined at 0.0 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 09:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 10:05 | **Volumes Purged** | | **Sample ID** | VRTB-L-B1_07172024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 10:00 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 09:40 | 0 | 0 | 200 | 0.00 | 0.26 | 7.77 | 0.293 | 2.71 | 1.38 | 14.4 | 66.1 | Clear | None |
| 09:45 | 5 | 5 | 200 | 0.00 | 0.53 | 7.73 | 0.293 | 2.32 | 1.59 | 14.4 | 66.8 | Clear | None |
| 09:50 | 5 | 10 | 200 | 0.00 | 0.79 | 7.73 | 0.292 | 2.21 | 1.65 | 14.1 | 69.5 | Clear | None |
| 09:55 | 5 | 15 | 200 | 0.00 | 1.06 | 7.72 | 0.291 | 2.16 | 1.67 | 13.9 | 71.3 | Clear | None |
| 10:00 | 5 | 20 | 200 | 0.00 | 1.32 | 7.71 | 0.29 | 2.04 | 1.69 | 13.9 | 71.1 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-BB8 | | | **Date** | 7/17/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 73.4 degrees F and Partly Cloudy. The wind is blowing N/NW at 16.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 16:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:20 | **Volumes Purged** | | **Sample ID** | VRTB-L-BB8_07172024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:15 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:50 | 0 | 0 | 200 | 0.00 | 0.26 | 7.59 | 0.357 | 4.39 | 0.32 | 13.7 | -67.3 | Clear | None |
| 16:55 | 5 | 5 | 200 | 0.00 | 0.53 | 7.59 | 0.355 | 3.83 | 0.26 | 13.2 | -64.1 | Clear | None |
| 17:00 | 5 | 10 | 200 | 0.00 | 0.79 | 7.59 | 0.355 | 3.54 | 0.25 | 13.1 | -62.2 | Clear | None |
| 17:05 | 5 | 15 | 200 | 0.00 | 1.06 | 7.58 | 0.355 | 3.22 | 0.24 | 13.1 | -60.1 | Clear | None |
| 17:10 | 5 | 20 | 200 | 0.00 | 1.32 | 7.56 | 0.355 | 3.11 | 0.24 | 13.1 | -56.9 | Clear | None |
| 17:15 | 5 | 25 | 200 | 0.00 | 1.59 | 7.55 | 0.355 | 2.69 | 0.23 | 12.9 | -52.4 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-G4 | | | **Date** | 7/17/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 67.8 degrees F and . The wind is blowing NW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 12:20 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 13:15 | **Volumes Purged** | | **Sample ID** | VRTB-L-G4_07172024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 13:05 | **Gallons Purged** | | **Replicate/ Code No.** | DUP-02_07172024 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 12:25 | 0 | 0 | 200 | 0.00 | 0.26 | 7.75 | 0.368 | 25.6 | 0.36 | 14.6 | -165.6 | Clear | None |
| 12:30 | 5 | 5 | 200 | 0.00 | 0.53 | 7.98 | 0.353 | 21.24 | 0.25 | 14.9 | -186.4 | Clear | None |
| 12:35 | 5 | 10 | 200 | 0.00 | 0.79 | 8.13 | 0.343 | 12.65 | 0.17 | 15.2 | -208.7 | Clear | None |
| 12:40 | 5 | 15 | 200 | 0.00 | 1.06 | 8.23 | 0.337 | 11.83 | 0.13 | 15 | -219.2 | Clear | None |
| 12:45 | 5 | 20 | 200 | 0.00 | 1.32 | 8.33 | 0.33 | 5.68 | 0.11 | 14.9 | -229.4 | Clear | None |
| 12:50 | 5 | 25 | 200 | 0.00 | 1.59 | 8.38 | 0.328 | 5.11 | 0.1 | 15.2 | -234.4 | Clear | None |
| 12:55 | 5 | 30 | 200 | 0.00 | 1.85 | 8.41 | 0.325 | 4.88 | 0.09 | 15.3 | -238.7 | Clear | None |
| 13:00 | 5 | 35 | 200 | 0.00 | 2.11 | 8.44 | 0.323 | 4.19 | 0.09 | 15.3 | -241.4 | Clear | None |
| 13:05 | 5 | 40 | 200 | 0.00 | 2.38 | 8.47 | 0.32 | 4.04 | 0.09 | 15 | -242.7 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-M5 | | | **Date** | 7/17/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 67.8 degrees F and . The wind is blowing NW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 14:05 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 14:40 | **Volumes Purged** | | **Sample ID** | VRTB-L-M5_07172024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 14:35 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:10 | 0 | 0 | 200 | 0.00 | 0.26 | 7.65 | 0.319 | 13.53 | 0.69 | 15.9 | -32.7 | Clear | None |
| 14:15 | 5 | 5 | 200 | 0.00 | 0.53 | 7.61 | 0.309 | 7.12 | 1.54 | 16.1 | -39.3 | Clear | None |
| 14:20 | 5 | 10 | 200 | 0.00 | 0.79 | 7.62 | 0.307 | 5.52 | 1.57 | 16.1 | -35.6 | Clear | None |
| 14:25 | 5 | 15 | 200 | 0.00 | 1.06 | 7.64 | 0.305 | 3.73 | 1.57 | 16.1 | -30.6 | Clear | None |
| 14:30 | 5 | 20 | 200 | 0.00 | 1.32 | 7.63 | 0.306 | 3.13 | 1.57 | 16 | -27.3 | Clear | None |
| 14:35 | 5 | 25 | 200 | 0.00 | 1.59 | 7.63 | 0.305 | 2.77 | 1.58 | 15.8 | -24.4 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-O6 | | | **Date** | 7/17/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 72.5 degrees F and Partly Cloudy. The wind is blowing NW at 13.8 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 14:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:25 | **Volumes Purged** | | **Sample ID** | VRTB-L-O6_07172024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:20 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:50 | 0 | 0 | 200 | 0.00 | 0.26 | 7.67 | 0.334 | 7.89 | 0.45 | 13.5 | -33.7 | Clear | None |
| 14:55 | 5 | 5 | 200 | 0.00 | 0.53 | 7.55 | 0.337 | 4.46 | 0.86 | 15.5 | -62.2 | Clear | None |
| 15:00 | 5 | 10 | 200 | 0.00 | 0.79 | 7.55 | 0.337 | 4.09 | 1.04 | 15.4 | -51.4 | Clear | None |
| 15:05 | 5 | 15 | 200 | 0.00 | 1.06 | 7.55 | 0.336 | 3.73 | 1.14 | 15.7 | -45.6 | Clear | None |
| 15:10 | 5 | 20 | 200 | 0.00 | 1.32 | 7.55 | 0.336 | 3.41 | 1.21 | 15.6 | -40.6 | Clear | None |
| 15:15 | 5 | 25 | 200 | 0.00 | 1.59 | 7.56 | 0.335 | 3.22 | 1.29 | 15.3 | -34.5 | Clear | None |
| 15:20 | 5 | 30 | 200 | 0.00 | 1.85 | 7.56 | 0.337 | 2.97 | 1.33 | 15.4 | -31.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-P7 | | | **Date** | 7/17/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 73.4 degrees F and Partly Cloudy. The wind is blowing N/NW at 16.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 15:40 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:20 | **Volumes Purged** | | **Sample ID** | VRTB-L-P7_07172024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:15 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:45 | 0 | 0 | 200 | 0.00 | 0.26 | 7.68 | 0.357 | 8.54 | 0.34 | 15.2 | -153.8 | Clear | None |
| 15:50 | 5 | 5 | 200 | 0.00 | 0.53 | 7.67 | 0.297 | 3.64 | 0.16 | 14.7 | -161.7 | Clear | None |
| 15:55 | 5 | 10 | 200 | 0.00 | 0.79 | 7.77 | 0.293 | 2.58 | 0.05 | 14.4 | -174.3 | Clear | None |
| 16:00 | 5 | 15 | 200 | 0.00 | 1.06 | 7.84 | 0.291 | 2.14 | 0.03 | 14.7 | -182.8 | Clear | None |
| 16:05 | 5 | 20 | 200 | 0.00 | 1.32 | 7.89 | 0.29 | 1.72 | 0.03 | 14.5 | -187.5 | Clear | None |
| 16:10 | 5 | 25 | 200 | 0.00 | 1.59 | 7.95 | 0.289 | 1.52 | 0.03 | 14.5 | -192.9 | Clear | None |
| 16:15 | 5 | 30 | 200 | 0.00 | 1.85 | 7.97 | 0.288 | 1.44 | 0.03 | 14.2 | -197.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-S2 | | | **Date** | 7/17/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 68.4 degrees F and Clear. The wind is blowing undefined at 0.0 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 10:15 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 11:20 | **Volumes Purged** | | **Sample ID** | VRTB-L-S2_07172024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 11:05 | **Gallons Purged** | | **Replicate/ Code No.** | MS/MSD | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 10:20 | 0 | 0 | 200 | 0.00 | 0.26 | 10.22 | 0.3 | 13.31 | 0.53 | 14 | -63 | Clear | None |
| 10:25 | 5 | 5 | 200 | 0.00 | 0.53 | 9.71 | 0.268 | 12.46 | 0.34 | 13.8 | -76.5 | Clear | None |
| 10:30 | 5 | 10 | 200 | 0.00 | 0.79 | 9.57 | 0.266 | 12.02 | 0.28 | 13.9 | -86.5 | Clear | None |
| 10:35 | 5 | 15 | 200 | 0.00 | 1.06 | 9.44 | 0.266 | 9.54 | 0.25 | 13.9 | -98.7 | Clear | None |
| 10:40 | 5 | 20 | 200 | 0.00 | 1.32 | 9.38 | 0.266 | 8.36 | 0.24 | 14 | -105.5 | Clear | None |
| 10:45 | 5 | 25 | 200 | 0.00 | 1.59 | 9.35 | 0.267 | 7.88 | 0.24 | 13.9 | -109.5 | Clear | None |
| 10:50 | 5 | 30 | 200 | 0.00 | 1.85 | 9.32 | 0.268 | 7.34 | 0.26 | 14 | -111.8 | Clear | None |
| 10:55 | 5 | 35 | 200 | 0.00 | 2.11 | 9.29 | 0.268 | 7.06 | 0.29 | 14 | -113.2 | Clear | None |
| 11:00 | 5 | 40 | 200 | 0.00 | 2.38 | 9.24 | 0.269 | 6.75 | 0.31 | 14 | -113 | Clear | None |
| 11:05 | 5 | 45 | 200 | 0.00 | 2.64 | 9.22 | 0.27 | 6.49 | 0.32 | 14.2 | -111 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-L-Y3 | | | **Date** | 7/17/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 67.8 degrees F and . The wind is blowing NW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 11:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 12:10 | **Volumes Purged** | | **Sample ID** | VRTB-L-Y3_07172024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 12:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 11:40 | 0 | 0 | 200 | 0.00 | 0.26 | 7.67 | 0.409 | 3.32 | 4.61 | 15.3 | 54.6 | Clear | None |
| 11:45 | 5 | 5 | 200 | 0.00 | 0.53 | 7.79 | 0.301 | 2.02 | 8.16 | 15.1 | 59 | Clear | None |
| 11:50 | 5 | 10 | 200 | 0.00 | 0.79 | 7.77 | 0.287 | 1.89 | 8.21 | 15.3 | 65 | Clear | None |
| 11:55 | 5 | 15 | 200 | 0.00 | 1.06 | 7.77 | 0.285 | 1.75 | 8.44 | 14.4 | 71.2 | Clear | None |
| 12:00 | 5 | 20 | 200 | 0.00 | 1.32 | 7.77 | 0.284 | 1.65 | 8.55 | 14.4 | 75.4 | Clear | None |
| 12:05 | 5 | 25 | 200 | 0.00 | 1.59 | 7.76 | 0.283 | 1.59 | 8.53 | 14.2 | 80.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-B1 | | | **Date** | 7/15/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 88.0 degrees F and Mostly Clear. The wind is blowing NW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 16:50 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:25 | **Volumes Purged** | | **Sample ID** | VRTB-S-B1_07152024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:20 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:55 | 0 | 0 | 200 | 0.00 | 0.26 | 7.62 | 0.378 | 16.18 | 0.61 | 14.9 | -36.2 | Clear | None |
| 17:00 | 5 | 5 | 200 | 0.00 | 0.53 | 7.59 | 0.372 | 6.79 | 1.21 | 16.9 | -30.5 | Clear | None |
| 17:05 | 5 | 10 | 200 | 0.00 | 0.79 | 7.56 | 0.37 | 4.36 | 1.55 | 17 | -25.4 | Clear | None |
| 17:10 | 5 | 15 | 200 | 0.00 | 1.06 | 7.57 | 0.366 | 3.47 | 1.81 | 16.9 | -16.6 | Clear | None |
| 17:15 | 5 | 20 | 200 | 0.00 | 1.32 | 7.58 | 0.364 | 3.11 | 1.89 | 16.8 | -10.1 | Clear | None |
| 17:20 | 5 | 25 | 200 | 0.00 | 1.59 | 7.58 | 0.361 | 2.8 | 1.94 | 16.9 | -9.7 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-G4 | | | **Date** | 7/15/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 83.8 degrees F and Mostly Cloudy. The wind is blowing N/NW at 3.4 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 19:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 20:00 | **Volumes Purged** | | **Sample ID** | VRTB-S-G4_07152024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 19:55 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 19:30 | 0 | 0 | 200 | 0.00 | 0.26 | 7.72 | 0.373 | 1.03 | 2 | 16.4 | 32.9 | Clear | None |
| 19:35 | 5 | 5 | 200 | 0.00 | 0.53 | 7.74 | 0.337 | 5.61 | 1 | 15.4 | 23.4 | Clear | None |
| 19:40 | 5 | 10 | 200 | 0.00 | 0.79 | 7.78 | 0.318 | 4.65 | 2.21 | 15.6 | 28.7 | Clear | None |
| 19:45 | 5 | 15 | 200 | 0.00 | 1.06 | 7.8 | 0.311 | 3.49 | 2.25 | 15.6 | 35.6 | Clear | None |
| 19:50 | 5 | 20 | 200 | 0.00 | 1.32 | 7.82 | 0.308 | 3.22 | 2.29 | 15.7 | 38.7 | Clear | None |
| 19:55 | 5 | 25 | 200 | 0.00 | 1.59 | 7.83 | 0.305 | 3.11 | 2.31 | 15.7 | 43.8 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-M5 | | | **Date** | 7/16/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 78.4 degrees F and Partly Cloudy. The wind is blowing W/NW at 13.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 14:25 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 15:10 | **Volumes Purged** | | **Sample ID** | VRTB-S-M5_07162024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 15:05 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 14:30 | 0 | 0 | 200 | 0.00 | 0.26 | 7.48 | 0.355 | 14.45 | 0.65 | 14.9 | 1 | Clear | None |
| 14:35 | 5 | 5 | 200 | 0.00 | 0.53 | 7.54 | 0.367 | 11.27 | 0.84 | 14.8 | 0.2 | Clear | None |
| 14:40 | 5 | 10 | 200 | 0.00 | 0.79 | 7.56 | 0.369 | 9.85 | 1.33 | 16.9 | 3.1 | Clear | None |
| 14:45 | 5 | 15 | 200 | 0.00 | 1.06 | 7.57 | 0.371 | 6.62 | 2.1 | 17.7 | 4.6 | Clear | None |
| 14:50 | 5 | 20 | 200 | 0.00 | 1.32 | 7.58 | 0.369 | 4.43 | 2.58 | 17.9 | 9.9 | Clear | None |
| 14:55 | 5 | 25 | 200 | 0.00 | 1.59 | 7.58 | 0.369 | 4.21 | 2.99 | 17.9 | 15.9 | Clear | None |
| 15:00 | 5 | 30 | 200 | 0.00 | 1.85 | 7.59 | 0.366 | 4.18 | 3.12 | 17.8 | 18.9 | Clear | None |
| 15:05 | 5 | 35 | 200 | 0.00 | 2.11 | 7.6 | 0.362 | 3.72 | 3.16 | 17.7 | 20.9 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-O6 | | | **Date** | 7/16/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 78.1 degrees F and Mostly Cloudy. The wind is blowing W/NW at 10.4 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 15:45 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 16:30 | **Volumes Purged** | | **Sample ID** | VRTB-S-O6_07162024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 16:25 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 15:50 | 0 | 0 | 200 | 0.00 | 0.26 | 7.63 | 0.295 | 2.02 | 0.68 | 17.4 | 46.5 | Clear | None |
| 15:55 | 5 | 5 | 200 | 0.00 | 0.53 | 7.63 | 0.309 | 1.94 | 0.38 | 17.7 | 30.7 | Clear | None |
| 16:00 | 5 | 10 | 200 | 0.00 | 0.79 | 7.64 | 0.308 | 1.75 | 0.98 | 18.5 | 23.6 | Clear | None |
| 16:05 | 5 | 15 | 200 | 0.00 | 1.06 | 7.65 | 0.307 | 1.61 | 1.53 | 18.8 | 18.7 | Clear | None |
| 16:10 | 5 | 20 | 200 | 0.00 | 1.32 | 7.68 | 0.307 | 1.43 | 2.49 | 18.5 | 25.9 | Clear | None |
| 16:15 | 5 | 25 | 200 | 0.00 | 1.59 | 7.69 | 0.301 | 1.34 | 3.62 | 19 | 35.6 | Clear | None |
| 16:20 | 5 | 30 | 200 | 0.00 | 1.85 | 7.71 | 0.299 | 1.31 | 3.69 | 19 | 39.8 | Clear | None |
| 16:25 | 5 | 35 | 200 | 0.00 | 2.11 | 7.72 | 0.297 | 1.14 | 3.75 | 18.5 | 42.5 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-P8 | | | **Date** | 7/16/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 77.0 degrees F and Partly Cloudy. The wind is blowing NW at 8.1 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 18:00 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:45 | **Volumes Purged** | | **Sample ID** | VRTB-S-P8_07162024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:40 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:05 | 0 | 0 | 200 | 0.00 | 0.26 | 11.47 | 0.699 | 6.61 | 4.27 | 16 | -58 | Clear | None |
| 18:10 | 5 | 5 | 200 | 0.00 | 0.53 | 11.38 | 0.551 | 3.39 | 4.89 | 15.4 | -51.1 | Clear | None |
| 18:15 | 5 | 10 | 200 | 0.00 | 0.79 | 11.25 | 0.465 | 3.31 | 5.82 | 15.4 | -40.2 | Clear | None |
| 18:20 | 5 | 15 | 200 | 0.00 | 1.06 | 11.17 | 0.441 | 3.05 | 6.23 | 15.4 | -32.5 | Clear | None |
| 18:25 | 5 | 20 | 200 | 0.00 | 1.32 | 11.12 | 0.433 | 2.67 | 6.72 | 15.2 | -27 | Clear | None |
| 18:30 | 5 | 25 | 200 | 0.00 | 1.59 | 11.08 | 0.421 | 2.44 | 6.79 | 15.2 | -21.1 | Clear | None |
| 18:35 | 5 | 30 | 200 | 0.00 | 1.85 | 11.06 | 0.417 | 2.23 | 6.83 | 15.1 | -18.9 | Clear | None |
| 18:40 | 5 | 35 | 200 | 0.00 | 2.11 | 11.02 | 0.409 | 1.91 | 6.89 | 15.1 | -16.5 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-R7 | | | **Date** | 7/16/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 76.8 degrees F and Mostly Cloudy. The wind is blowing W/NW at 11.4 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 16:50 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 17:45 | **Volumes Purged** | | **Sample ID** | VRTB-S-R7_07162024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 17:35 | **Gallons Purged** | | **Replicate/ Code No.** | DUP-01_07162024 | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 16:55 | 0 | 0 | 200 | 0.00 | 0.26 | 7.63 | 0.405 | 7.31 | 0.95 | 16.9 | 58.8 | Clear | None |
| 17:00 | 5 | 5 | 200 | 0.00 | 0.53 | 7.61 | 0.398 | 18.5 | 0.86 | 17.7 | 39.9 | Clear | None |
| 17:05 | 5 | 10 | 200 | 0.00 | 0.79 | 7.61 | 0.397 | 11.6 | 0.9 | 17.8 | 36.5 | Clear | None |
| 17:10 | 5 | 15 | 200 | 0.00 | 1.06 | 7.61 | 0.395 | 5.67 | 1.02 | 17.8 | 32.5 | Clear | None |
| 17:15 | 5 | 20 | 200 | 0.00 | 1.32 | 7.61 | 0.392 | 4.69 | 1.15 | 17.7 | 32.2 | Clear | None |
| 17:20 | 5 | 25 | 200 | 0.00 | 1.59 | 7.62 | 0.39 | 4.11 | 1.28 | 17.5 | 33.9 | Clear | None |
| 17:25 | 5 | 30 | 200 | 0.00 | 1.85 | 7.61 | 0.388 | 3.68 | 1.42 | 17.5 | 36 | Clear | None |
| 17:30 | 5 | 35 | 200 | 0.00 | 2.11 | 7.61 | 0.387 | 3.11 | 1.5 | 17.8 | 37.8 | Clear | None |
| 17:35 | 5 | 40 | 200 | 0.00 | 2.38 | 7.62 | 0.384 | 2.71 | 1.54 | 17.7 | 42.2 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-S2 | | | **Date** | 7/15/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 85.8 degrees F and Mostly Clear. The wind is blowing N/NW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 17:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 18:15 | **Volumes Purged** | | **Sample ID** | VRTB-S-S2_07152024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 18:10 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 17:40 | 0 | 0 | 200 | 0.00 | 0.26 | 7.73 | 0.371 | 5.37 | 1.46 | 16.4 | 38.4 | Clear | None |
| 17:45 | 5 | 5 | 200 | 0.00 | 0.53 | 7.72 | 0.373 | 3.19 | 0.85 | 16.4 | 16.6 | Clear | None |
| 17:50 | 5 | 10 | 200 | 0.00 | 0.79 | 7.7 | 0.365 | 2.88 | 1.14 | 16.5 | 21.3 | Clear | None |
| 17:55 | 5 | 15 | 200 | 0.00 | 1.06 | 7.64 | 0.35 | 2.34 | 1.47 | 16.5 | 25.9 | Clear | None |
| 18:00 | 5 | 20 | 200 | 0.00 | 1.32 | 7.6 | 0.338 | 2.01 | 1.67 | 16.5 | 29.3 | Clear | None |
| 18:05 | 5 | 25 | 200 | 0.00 | 1.59 | 7.6 | 0.336 | 1.81 | 1.71 | 16.4 | 30.2 | Clear | None |
| 18:10 | 5 | 30 | 200 | 0.00 | 1.85 | 7.6 | 0.331 | 1.64 | 1.75 | 16.6 | 33.3 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# Groundwater Sampling Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Number** | 30027244 | **Well ID** | VRTB-S-Y3 | | | **Date** | 7/15/2024 |
| **Project Name/Location** | ESTCP Full Proposal for Verteb | | **Weather(°F)** | 85.8 degrees F and Mostly Clear. The wind is blowing N/NW at 6.9 mph. | | | |
| **Measuring Pt. Description** | Other | **MP Elevation** | | **Casing Diameter (in)** | | **Well Casing Material** | |
| **Static Water Level (ft-bmp)** | 0.00 | **Total Depth (ft-bmp)** | 0 | **Water Column (ft)** | 0.00 | **Gallons in Well** | |
| **Purge Start** | 18:35 | **Pump Intake (ft-bmp)** | | **Purge Method** | Low-Flow | **Purge Equipment** | Peristaltic |
| **Purge End** | 19:15 | **Volumes Purged** | | **Sample ID** | VRTB-S-Y3_07152024 | **Sampled by** | Austin Westhuis |
| **Sample Time** | 19:10 | **Gallons Purged** | | **Replicate/ Code No.** | NA | **Sample Type** | Grab |

| Time | Minutes Elapsed | Total Elapsed Minutes | Rate mL/min | Depth to Water (ft) | Gallon Purged | pH (standard units) | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Temperature °C | Redox (mV) | Appearance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Color | Odor |
| 18:40 | 0 | 0 | 200 | 0.00 | 0.26 | 8.1 | 0.549 | 46.78 | 0.61 | 14.9 | -63.6 | Clear | None |
| 18:45 | 5 | 5 | 200 | 0.00 | 0.53 | 8.11 | 0.522 | 42.11 | 0.35 | 15.2 | -102.4 | Clear | None |
| 18:50 | 5 | 10 | 200 | 0.00 | 0.79 | 8.02 | 0.483 | 40.24 | 0.78 | 15.4 | -102.5 | Clear | None |
| 18:55 | 5 | 15 | 200 | 0.00 | 1.06 | 7.91 | 0.449 | 39.85 | 1.61 | 15.2 | -86.4 | Clear | None |
| 19:00 | 5 | 20 | 200 | 0.00 | 1.32 | 7.86 | 0.436 | 36.65 | 1.66 | 15.4 | -82.4 | Clear | None |
| 19:05 | 5 | 25 | 200 | 0.00 | 1.59 | 7.85 | 0.432 | 35.97 | 1.71 | 15.3 | -77.8 | Clear | None |
| 19:10 | 5 | 30 | 200 | 0.00 | 1.85 | 7.85 | 0.426 | 35.11 | 1.74 | 15.3 | -76.4 | Clear | None |

**Comments:**

**Well Casing Volume Conversion**

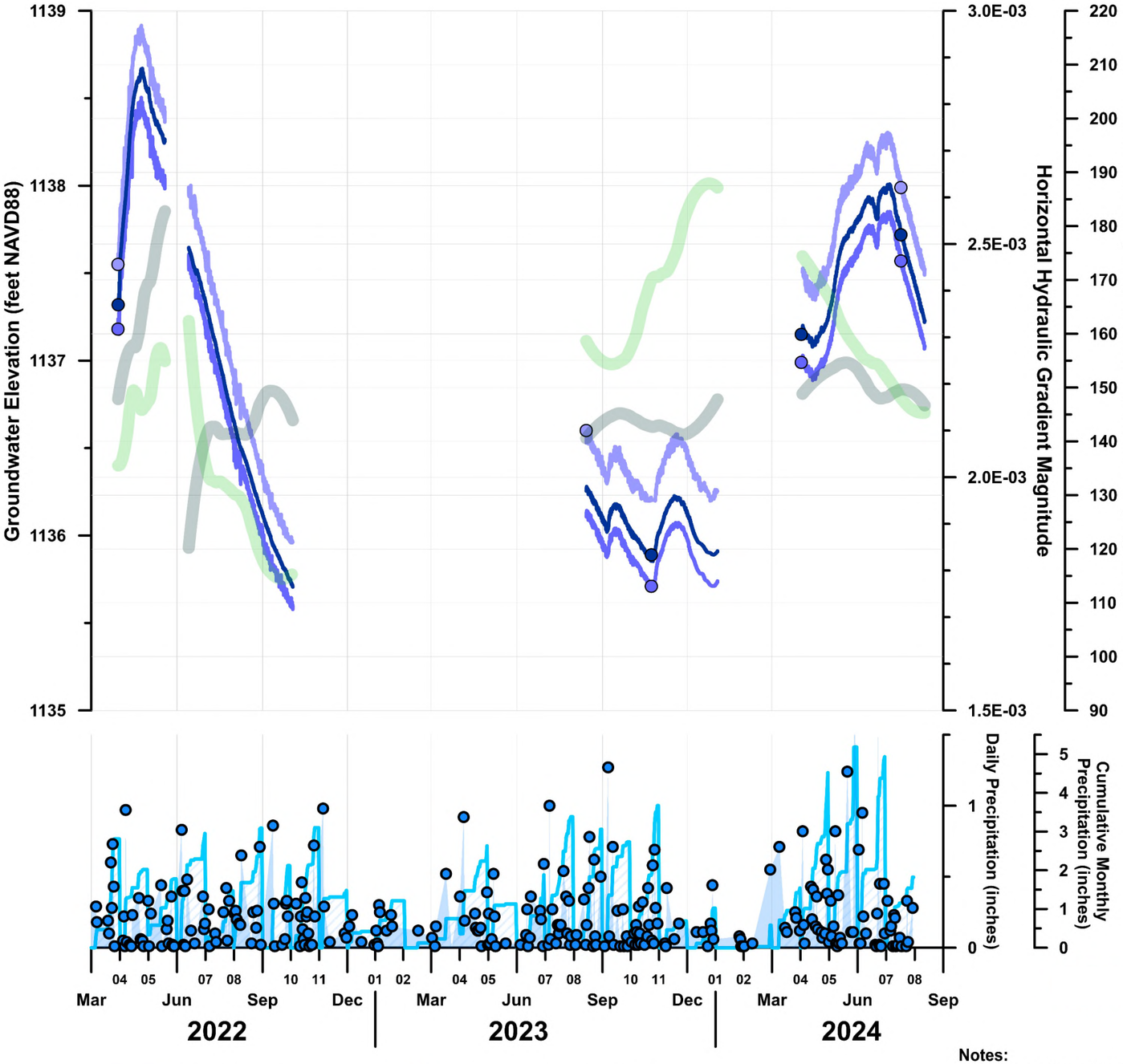
Well diameter (inches) = gallons per foot — 1 = 0.04; 1.5 = 0.09; 2.5 = 0.26; 3.5 = 0.50; 6 = 1.47
1.25 = 0.06; 2 = 0.16; 3 = 0.37; 4 = 0.65

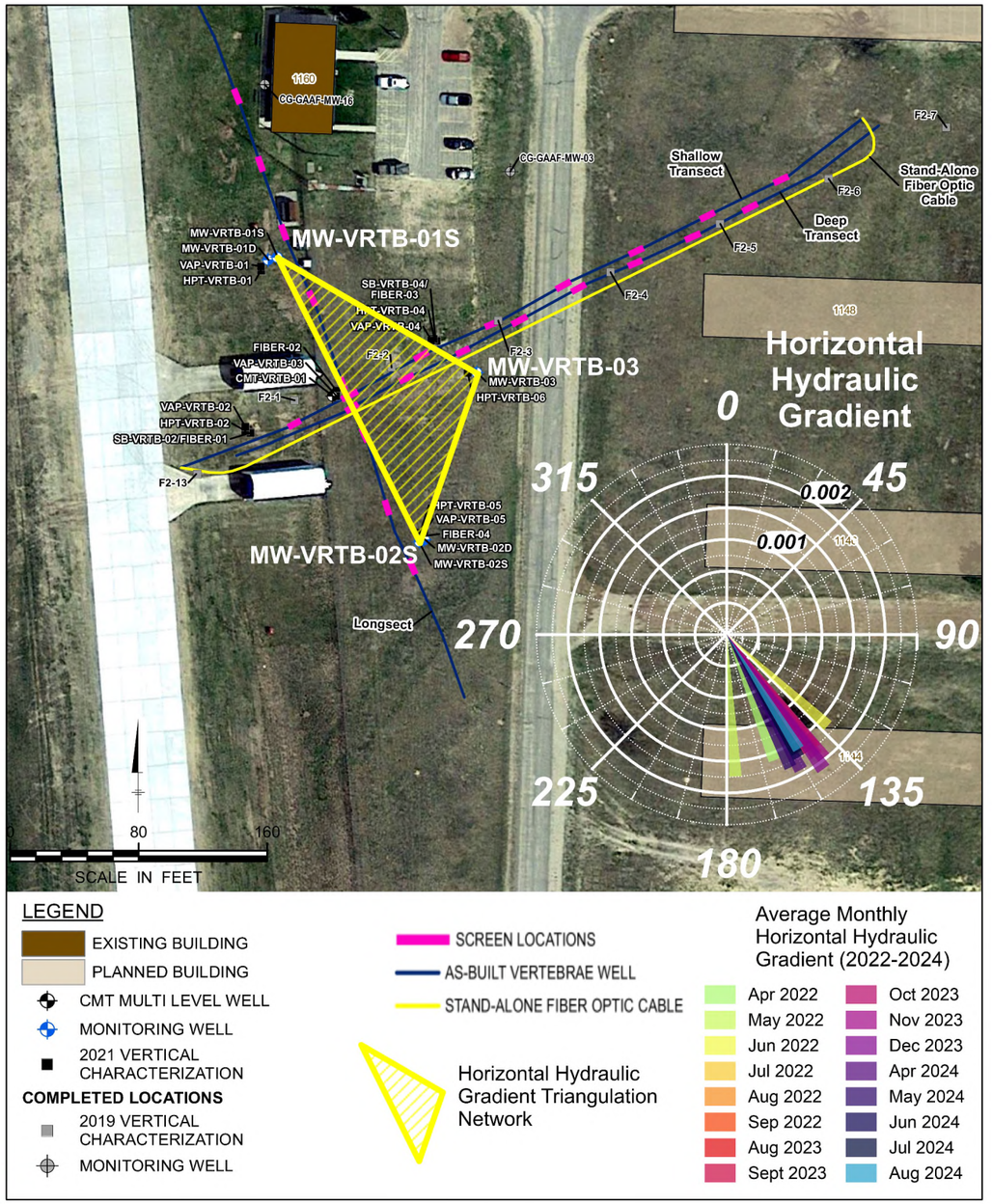
**Well Information**

Well Location: See figure.
Condition of Well: Good condition
Well Completion: Flush mount
Well Locked at Arrival: no
Well Locked at Departure: no
Key Number To Well: NA

ft-bmp = feet below measuring point
in = inches
ft = feet
mL/min = milliliters per minute
mS/cm = milliSiemens per centimeter
NTU = Nephelometric Turbidity Unit
mg/L = milligrams per liter
mV = millivolts
°F = degrees Fahrenheit
°C = degrees Celsius

# APPENDIX J HYDRAULIC GRADIENT ANALYSIS




**Notes:**

1. Hydrographs calibrated to survey point datum (North American Vertical Datum 1988).
2. Horizontal hydraulic gradient calculations using hourly data from the three monitoring wells (Devlin, J.F., 2003. A spreadsheet method of estimating best -fit hydraulic gradients using head data from multiple wells. Groundwater, 41(3)).
3. Daily precipitation data with liquid snowfall equivalent processed to include precipitation data when air temperature above freezing. Data obtained from National Oceanic and Atmospheric Association (National Centers for Environmental Information) Grayling, MI Station (GHCND: USC00203391).

ESTCP ER20-5026
Grayling Army Air Field
Grayling, Michigan

**Hydrographs and Horizontal Hyraulic Gradient**

ARCADIS

APPENDIX J